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A HANDBOOK

OF THE

GNATS OR MOSQUITOES

A HANDBOOK

OF THE

GNATS OR MOSQUITOES

GIVING

THE ANATOMY AND LIFE HISTORY

OF THE

CULICIDÆ

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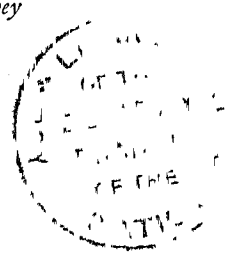
BY

MAJOR GEO. M. GILES

I.M.S., M.B.LOND., F.R.C.S.

Formerly Naturalist to the Indian Marine Survey



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PREFACE.

FOR all who are interested in tropical medicine, the *rôle* played by insects in general, and of the *Culicidæ* in particular, in the transmission of disease, is a subject of rapidly increasing importance.

The researches of Manson, in China, of Bancroft, in Australia, and lastly, of Major Ronald Ross, I.M.S., in India and Africa, have rendered an exact knowledge of the habits and classification of the *Culicidæ* of as great moment to the student of tropical medicine, as those of the *bacteria* are to the investigator of the more common diseases of the world in general.

The literature of the subject is, however, scattered throughout the scientific periodicals of many languages, and is necessarily quite inaccessible to men who must necessarily conduct their researches far from all libraries and museums.

The connection of gnats with the transmission of malaria and filariasis may now, I think, be accepted as proved. The series of specimens shown me by Major Ross appears to me, as far as malaria is concerned, perfectly convincing on this point for any one who is familiar with the general data of helminthology ; but as yet, the capability of acting as the intermediate host of malarial parasite is established for but one or two species of the genus *Anopheles*, and a wide field of investigation is opened out in the determination of what species can, or can not act as vehicles of the disease, and in the observation of the habits and life-history of such species as prove to be obnoxious in this respect.

To conduct efficiently such investigations, a knowledge of the habits and classification of these insects is certainly essential, and the necessary literature for their identification should be available for the worker on the spot. Hence, hoping to have some opportunities of working at some of these problems on my return to India, I set myself to make extracts of such general papers as appeared to be best suited to my requirements, and to transcribe the published descriptions of all known species to which I could gain access. The original intention was merely to collect these notes into a bundle for my own use, but as the pile of manuscript grew, it appeared rather a waste of labour not to reproduce them in type for the use of others interested in the same studies, and this has resulted in my stringing together and arranging the collected notes in book-form.

In the general portion of the work, I have endeavoured, as far as possible, to verify, by personal observation and dissection, the various points advanced by the different authors quoted; and in the systematic portion, will be found arranged and tabulated, descriptions of all species to which I could obtain access.

In the majority of cases, a transcription or translation of the original description is given; but as my object has been rather to bring together, in English dress, such descriptions as are most convenient for purposes of identification, than to attempt the production of a technical monograph, I have, where possible, availed myself of the labours of those who have been at the pains to revise the descriptions of the species apertaining to particular regions. Thus the descriptions of the European species are taken mostly from Ficalbi's excellent work on the subject; those of Australia, from Skuse; and those of Argentina, from Arribálzaga. The advantage of this course is that the old, and generally quite incomplete descriptions are found, in such works, often supplemented by the personal observations of the reviser. There remains, of course, the doubt if the insect

referred to by original authority and reviser be the same, but the latter is at least more likely to be correct on such a point than the average amateur naturalist, and for the specialist, there is seldom any difficulty in consulting the original works. In the case of some of the longer descriptions, the phraseology has occasionally been curtailed of some of its redundant verbiage, but the majority are given in full. In some cases, I have added additional notes, based on an examination of the collections of the British Museum, and of the Paris Jardin des Plantes, and I must here express my grateful appreciation of the kindness and helpfulness I have met with from the authorities of these two great institutions, and to none more than to Mr. Austen, the Dipterologist of the British Museum, and to M. Robert du Buysson, of the Entomological Department of the Jardin des Plantes.

It will, I hope, be remembered that this is the first attempt to collect the descriptions of the entire family, and that, on this account, it is only to be expected that a certain number of descriptions should be overlooked. In a few cases, I have been unable to obtain, in England, the descriptions of certain species to which I have references, and doubtless others have escaped notice.

To facilitate the identification of specimens a table of the characters of the various species of each Genus has been drawn up, and each description is prefaced by a short diagnosis enumerating the characteristics that determine its position on the table, and distinguish it from its neighbours. All descriptions, including the conventional short Latin diagnosis, have been translated into English, and as publications in no less than eight languages have had to be consulted, it is, I fear, not improbable that some inaccuracies, due to my imperfect acquaintance with the majority of them, may have crept in.

There is little doubt that, in many cases, more than one description refers in reality to a single species, but on this

question of synonymy I have scarcely touched, save in a few individual cases; and where I have ventured to suggest the identity of two or more described species, as a rule the descriptions of all are furnished.

In conclusion, I desire to convey my thanks for the kindness and assistance I have met with from others interested in the subject; to Mr. F. V. Theobald, who most generously put at my disposal the rough notes on the *Culicidæ* for his forthcoming second volume on "British Flies;" to Major Ross for the loan of the block illustrating the report of the Liverpool Malarial Expedition, and to our West Country entomologist, Mr. Bignell, for some fine photographs of the wings of gnats and allied Genera.

J. M. GILES.

Byfield Mannamead,
Plymouth.
January, 1900.

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LIST OF ABBREVIATED QUOTATIONS.

The following quotations recur so frequently that it appears more convenient to employ abbreviated references in their case, in place of citing them in full :—

Desv. Essai .....Robineau Desvoidy, "Essai sur les Culicides, Mém. de la Soc. d'Hist. Nat. de Paris," III., p. 390, *et seq.* (1827).

D. Sc. .....Zetterstedt, "Diptera Scandinaca."

F. A. .....F. A. Schiner, "Diptera Austeriaca."

Fab. E. S. .....Fabricius, "Entomolog. Syst.," IV. (1794).

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F. R. .....Eugenio Ficalbi, "Revisione delle Specie Europei della Fagmilia delle Zanzare," Bull. Soc. Ent. Ital., 1896, p. 239, *et seq.*

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Wied. A. Z. I.....Wiedemann, "Aussereurop. Zweiflüg. Insec." (1828).

Wied. D. E. .....Wiedemann, "Diptera Exotica." I. (1821).

A HANDBOOK

OF THE

GNATS OR MOSQUITOES

PART I.—GENERAL

CHAPTER I.

On the Position and Terminology of the Culicidæ.

WITHOUT entering into minute detail, it may be well to premise that the *Culicidæ* belong to the Order of *Diptera* or two-winged insects, in which the hinder of the two pairs of wings of the typical insect are absent as such, and are represented only by a pair of small club-like bodies, the halteres or balancers. All the members of this Order undergo a complete metamorphosis, *i.e.*, they are hatched as worm-like *larvæ*, and after attaining, as to size, if not as to form, the dimensions of the adult insect, and undergoing several changes of skin, they cease to eat, undergo profound anatomical changes, and become nymphs or *pupæ*, and, finally, by a last change of skin, they emerge from the pupa case as the externally, entirely different *imago*, or adult insect.

The *Diptera* are divided into two Sub-orders, the *Orthorrapha* and the *Cyclorrhapha*, according to the method by which the pupæ escape from the larval skin. In the former the rupture is in the form of a T-shaped rent, and the larva is "encephalous," *i.e.*, has a more or less perfectly developed chitinous head; in the latter, the pupæ escape by a circular opening and the larva has no chitinous first segment, but is quite acephalous. It is obvious that this division, though associated with fundamental structural differences, is of

little value to the observer who possesses only the perfect insect, but none of the *Cyclorrhapha* are at all likely to be confused with Mosquitoes, and the sub-divisions of the *Orthorrhapha* are marked by characters of a very obvious sort in the adult insect; the Sub-order being divided in a very natural manner, into two sub-divisions, by the characters of the antennæ. In the *Nematocera*, to which the *Culicidæ* belong, the antennæ are large and prominent organs, consisting of more than six joints, and the palp of four or five joints, while in the *Brachycera* the antennæ are of insignificant dimensions, consisting of but two or three apparent joints, and the palpi are also but one or two jointed. Osten-Sacken further sub-divides the *Nematocera* into the true, and the anomalous groups of families. The true *Nematocera*, which include the *Cecidomyidæ*, *Mycetophilidæ*, *Culicidæ*, *Chironomidæ*, *Tipulidæ*, *Psychodidæ*, and possibly the *Dixidæ*, have the following characters :—

(1) The eyes are never blended into a single mass, and there is little or no difference in the size of the head and eyes in the two sexes.
(2) Eyes round, oval or lunate; they may meet but never blend.
(3) Antennæ very large in proportion to the small head.
(4) Legs long and weak, not fitted for walking.
(5) Generally slighter, and more slender.
(6) Inhabit damp, shady places, and prefer twilight.

The anomalous *Nematocera*, which include the *Simulidæ* or sand-flies, the *Bibionidæ*, *&c.*, on the other hand, are characterised as follows :-

(1) Head generally holoptic in both sexes, nearly always so in the male.
(2) Eyes often bisected, the upper facets being the largest.
(3) Legs well adapted for walking and often thick.
(4) The sexes generally differ considerably.
(5) Have a peculiar, and often sporadic geographical distribution.

The *Pulicidæ*, or fleas, are now included in the anomalous *Nematocera* by the majority of authorities.

Confining our attention to the true *Nematocera*, the *Culicidæ* may, for practical purposes, be easily distinguished from the other families by two very obvious characters. The first of these is the possession of the long, suctorial proboscis, which differs markedly from the mouth parts of any insect likely to be confused with them; and the second is that in all, the veins of the wings are fringed with scales like those of butterflies and moths. It is true that the wings of certain genera, such as *Molopheles* and *Ryphacophua* have the veins of the wings scaly, but even in the former the scales are very elongated, while in the latter they are more of the character of hairs, and in both the general arrangement of the scales is of a shaggy and irregular character as compared with that of the *Culicidæ*, apart from which they present unmistakable differences in the venation of the wings.

The family that is most easily confused with the *Culicidæ* is the *Chironomidæ* or midges, which not only frequent very much the same situations, but in general form so closely resemble the gnats that they can scarcely be distinguished by the naked eye; but this family has neither the long proboscis nor the scaly wing veins, and a moment's examination with a lens suffices to distinguish them.

Those who wish to follow more closely the question of the classification of the *Nematocera* are recommeded to consult Mr. F. V. Theobald's "Account of British Flies," which is not only very plainly written, but appears more up to date than most of the accessible works on the subject in the English language. Although as yet it is, unfortunately, not completed, it contains a most handy synopsis of the genera of the Order, and will, therefore, be most useful to anyone commencing the study of any group of Diptera, even in tropical regions, for it must be remembered, that the Dipterous fauna of India, and most other tropical parts, remains to be written, so that a knowledge of the general principles of the classification can only be gained from European and American works.

Hitherto I have treated the terms *Culicidæ*, Mosquitoes, and gnats as synonymous, and the present work is confined

to the consideration of the *Culicidæ* alone; but it must not be supposed that every insect that bites and is annoying to man is necessarily one of that family. As far as we at present are aware, however, it is the *Culicdæ* alone that are concerned in the transmission of malaria, and as this little book is mainly intended for the use of those who may be working on this problem, it does not appear worth while to include the *Simulidæ* and other obnoxious insects that attack man in the same way.

The word Mosquito is a diminutive of the Spanish and Portuguese "mosco" fly. A variety of insects of the *Culicidæ* and other families are known under this name in various localities, the only common characteristic being the power of annoying man by their bites. It is not uncommon to see in the press notices of the occurrence of "Mosquitoes" in England. When investigated by competent entomologists, the insects always turn out to be one of the common indigenous English gnats, generally *C. pipiens*, *L.*; and in point of fact, this species has as good a claim as any other to the name, and is quite capable of inflicting as much annoyance as any other, the tropical species surpassing our English gnat rather in numbers and persistence than in their individual capability of annoyance. Something of the same sort may be noticed in the case of the common fly, which even where fairly common, rarely exhibits in England the same dire determination to sit on one's nose that it does in India and other hot climates, and which it will do, even in England when the weather is sufficiently hot. In short, the question whether gnats will earn for themselves the dreaded title of Mosquito or not is rather a matter of temperature than locality, or, in other words, it is only in hot weather that gnats show any strong tendency to attack human beings in place of being content with their more usual vegetable food. At any rate no one species is in any way entitled to the name.

On this point, Mr. F. V. Theobald remarks: "Much difference exists between the so-called Mosquitoes of various parts of the world. Some are true gnats, others sand-flies (*Simulidæ*), and yet others midges or *Chironomidæ* of the genus

Cerato-pogon. American Mosquitoes belong to the genera *Culex* and *Simulium;* that of Cuba, according to Desvoidy, is a *Culex;* in Brazil, the Mosquito is a small *Simulium*, sharing the honour with a *Culex* (*C. molestus*), according to Pohl and Kollar. From the West Coast of Africa, I have had several kinds of Mosquito sent, including one or two *Culicidæ*, but some were midges. It will thus be seen that the term is no guide to the family of insects to which any given 'Mosquito' belongs. In any case, they all belong to families which are found in greatest abundance in swampy places."

In almost all cases it is the female alone that attacks man and animals, an exception being noted in the case of *C. salinus* by Ficalbi, in his description of that species; but, however bloodthirsty they may be, it is obvious that they must mainly depend on other nourishment than blood, for these insects are commonest in just the places where air-breathing vertebrates are most uncommon. In England, and probably in other parts of the world, gnats may be seen feeding upon the nectar of flowers, and here it is certainly their usual food, a fact I have often verified by personal observation; but Mr. Theobald has also seen *C. ciliaris* sucking the juices of small *Diptera*. The peculiarity of the females alone being addicted to blood-sucking is shared with the *Tabanidæ* or gad-flies, whose males, too, live entirely on the juices of flowers.

Coming now to the question of terminology, it may first be observed that the terms used by Dipterologists, are generally the same as those used by entomologists generally, with such modifications and additions as are required by the special peculiarities of the Order. Unfortunately, neither among the former nor the latter is there any agreement as to the terms employed. It would be impossible, in any moderate compass, to cover even the practice of the best known authorities, and it is therefore only practicable to transcribe the views of a single author on this subject, whose work has been selected because, without expressing any preference for it over that of others, it represents, I think, better than that of any other author what may be called the average practice in the matter.

In the systematic portion of this book, following the usual practice in such cases, the published descriptions have been transcribed or translated as they stand, and it is only in cases where I have been able to supplement the original descriptions by personal observation of the species in question, that Loew's terminology, as given below, is followed. The article referred to is given, by way of introduction, by Loew to his "Monographs of the *Diptera* of North America," published by the Smithsonian Institution, Washington, 1862, and in it, he defines the terms in most common use as follows.—In a few places I have introduced a few interpolated remarks, to meet the special and limited objects of the present work.

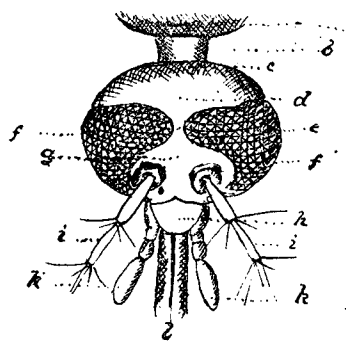


FIG. 1.—HEAD OF FEMALE CULEX.

a, thorax; *b*, neck; *c*, nape; *d*, occiput; *e*, vertex; *f*, eyes; *g*, frons; *h*, clypeus; *i*, antennæ; *k*, palpi; *l*, proboscis.

The head has a hinder plane, opposite the thorax, called the occiput (*occiput*); that region of it lying over the junction of the head is the nape (*cervix*). The part of the head which reaches from the antennæ as far as the occiput, and is limited laterally by the compound eyes, is the front (*frons*), the upper part of which is the crown (*vertex*), the limit between the front and the occiput having the name of the vertical margin (*margo verticalis*). The middle of the front, being often of a more membranous substance and sometimes differing in colour from its borders, is called the

frontal stripe (*vitta frontalis*). On the crown are the simple eyes (*ocelli*), which, however, are absent in the *Culicidæ*, but in the majority of *Diptera* are usually three in number and forming a triangle, sometimes on a sharply defined triangular space, the ocellar triangle (*triangulum ocellœ*). Most of those *Diptera* which undergo their metamorphosis within the larva skin possess, immediately above antennæ, an arcuate line, impressed, which seems to separate from the front, a small, usually crescentis piece, the frontal crescent (*lunula frontalis*). The impressed line itself, which continues over the face nearly as far as the border of the mouth, is called the frontal fissure (*fissura frontalis*). It owes its origin to a large bladder-like expansion, which exists at this place in immature imagines, and which helps them in bursting the pupa case. The frontal fissure is, of course, the true anterior limit of the front, and the frontal crescent in fact belongs to the face; however, on account of its usual situation, it is commonly considered as part of the front. In many genera the eyes of the males meet on the front, so as to divide it into two triangles, the upper of which is called the vertical triangle (*triangulum verticale*), the inferior, the anterior frontal triangle (*triangulum frontale anterium*) or simply the frontal triangle. The anterior portion of the head, reaching from the antennæ to the oral margin (*peristomium*) is called the face (*facies*). In most Diptera, it is divided into three parts adjoining each other, the limits of which depend on the situation of the frontal fissure, continued to the oral margin, occupies in the developed imago. The form, and mutual proportion in size, of these parts are of the highest value in the classification and distinction of species. Beneath the antennæ there are, in many *Diptera*, longitudinal grooves for their reception, the antennal furrows (*foveæ antennales*). The antennæ lie in these while in the pupa case, and sometimes even after escape. That part of the head which lies on the side beneath the eyes is called the cheek (*gena*). The compound eyes are sometimes encompassed in a greater or less portion of their circumference by a ring, somewhat swollen, and separated, more or less

distinctly from the rest of the surface of the head; and named the orbit, the successive parts of which may be called the anterior (*orbita anterior sire facialis*), the inferior (*inferior s. genalis*), the posterior (*posterior s. occipitalis*), the superior (*superior s. verticalis*), and the frontal (*frontalis*) orbits. An orbit is also often spoken of when there is no distinct ring; but in this case there is some difference of colour or structure to mark it off.

The oral parts of *Diptera*, destined for sucking, are called the sucker or proboscis. They are either inserted at the end of a more or less prolonged, cylindrical portion of the head called the snout (*rostrum*), or project from a wide aperture, often occupying a great part of the under surface of the head, called the mouth hole (*cantus oris*). The common, fleshy root of the oral parts is connected by a membrane with the border of the mouth. This membrane often has a fold of sometimes quite a horny consistence, and is then called the clypeus (*clypeus s. prælabrum*). It is either entirely concealed by the anterior border of the mouth, and is then usually movable, or it projects over it as a ridge, and is then usually immovable. The largest of the oral parts in most *Diptera* is the fleshy under lip (*labium*), consisting of the stem (*stipes*), and the knob (*capitulum labii*), formed by the two suctorial flaps (*labella*); and modified in the *Culicidæ* into the membranous, scaly sheath which encloses the other mouth parts. Besides the under lip the palpi are most perceptible, and must be noticed in the description of species. The remaining oral parts are generally rather small and stunted, having the form of bristles or horny lancets. They are considered as being the tongue (*lingua*), under jaws (*maxillæ*), upper jaws (*mandibulæ*), and upper lip (*labrum*), the latter shutting the under lip from above. These parts are not particularly valuable in the distinction of species.

As in other insects, the thorax of *Diptera* consists of three segments, the prothorax, the mesothorax, and the metathorax; but, in this Order, the mesothorax is so much more developed than the other segments, that it forms by far the largest part of the thorax, and in the description of

Diptera is exclusively designated by that name, while other names are given to the pro- and metathorax, when some particular part of them has to be characterised. The prothorax, being generally very little developed, sometimes forms a neck-like prolongation which bears the head, and is then called the neck (*collum*). Sometimes the fore corners of the mesothorax or shoulders (*humeri*) are covered by a lobe of the prothorax (*lobulus prothoracis humeralis*) distinctly separated from the mesothorax; but it is not uncommon for this to be soldered to the mesothorax so that no distinct limit is perceptible, except by differences of colour and armature: in which case, it is called the shoulder callosity (*callus humeralis*). Sometimes also the prothorax is closely applied to the anterior border of the mesothorax, and has then the name of the collar (*collare*). The mesothorax frequently also has a transverse furrow (*sutura transversalis*) crossing the middle of its upper side, and ending, on each side a little before the base of the wing; its presence or absence, as well as its form, furnishes characters of importance in classification. On each side of the *pleura* or "breast-side" there is, beneath the shoulder, a spiracle belonging to the prothorax (*stigma prothoracis*). To the back of the mesothorax applies the scutcheon (*scutellum*), separated from it by a furrow. Beneath the scutellum a part of the metathorax is to be seen called the metanotum, generally descending obliquely, often very convex, and on each side, a more or less inflated space, called the lateral callosity of the metanotum. The poisers (*halteres*) have their origin beneath this callosity, and before each is placed the stigma of the metathorax. In many *Diptera* these are protected by membranous covers placed above them, and called covering scales (*tegulæ s. squamæ*).

The abdomen is the third of the principal parts of the body, but the word often is applied to the dorsal side only, the under side being called the belly (*venter*). Its segments, as in other Orders, are counted from before back; but the anterior ones are often soldered together, while the posterior ones are stunted and concealed. Much caution

therefore is desirable in counting them. The statements as to their number are often rather arbitrary and conventional, and may require explanation. At the end of the abdomen we see in the male the claspers (*hypopygium*), in the female the ovipositor. If the claspers have the form of pincers, and are not bent under the belly, they are called forceps. The *Ovipositor* may be either a borer (*terebra*) or a style (*stylus*). Both organs are very important in the distinction of species in many families, and their structure being generally very complicated and varying much in different families, deserves a most attentive study.

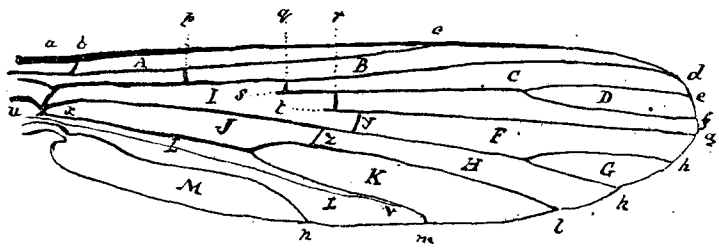


FIG. 2.—DIAGRAM ILLUSTRATING THE TERMINOLOGY OF THE WING, AS APPLIED TO CULICIDÆ.

VEINS.—*a*, *g*, costa; *b*, transverse numeral; *c*, auxiliary; *p*, sub-costal transverse; *d*, first longitudinal; *s*, *e*, *f*, second longitudinal; *t*, *g*, third longitudinal; *x*, *h*, *k*, fourth longitudinal; *x*, *l*, *m*, fifth longitudinal; *n*, sixth longitudinal; *q*, marginal transverse; *e*, anterior border of second longitudinal; *r*, supernumerary transverse; *y*, middle transverse; *h*, anterior branch of fourth longitudinal; *z*, posterior transverse; *l*, anterior branch of fifth longitudinal; *u*, *v*, incrassation of wing-fold.

CELLS.—*A*, costal; *B*, subcostal; *C*, marginal; *D*, first sub-marginal; *E*, second sub-marginal; *F*, first posterior; *G*, second posterior; *H*, third posterior; *I*, first basal; *J*, second basal; *K*, anal; *L*, axillary; *M*, spurious.

The neuration of the wings in *Diptera* forms so essential a foundation of their systematic arrangement, and is so useful for the distinction of species, that an accurate knowledge and a perfectly definite nomenclature is absolutely essential. It is essential to make out the parts that are homologous in the different families, as otherwise the terminology will be hopelessly confusing. At first sight the neuration differs so in the different families that it seems

impossible to reduce them to a common type, but on closer inspection they may all be reduced to a general plan, which is seen in its simplest form in the *Muscidæ*.

The framework of the neuration is formed by the longitudinal veins (*venæ longitudinales*), which are connected with each other by the transverse veins or venules.

The longitudinal veins spring from four trunks issuing from the base of the wing. The first and fourth being the least developed, the second and third must be taken as the main trunks, and their branches consequently as the main longitudinal veins of the wing. From the anterior of these two (the second) spring three branches, the anterior of which, or first longitudinal vein, runs parallel to the anterior border of the wing and joins it at a greater or less distance from the tip. The second, originating from the first generally before the middle of the wing, reaches the anterior border nearer the tip. Similarly the third longitudinal has its origin from the second. Three trunks spring also from the other (third) main trunk, which, counting from before back, are called the fourth, fifth, and sixth longitudinals.

The hindmost branch of the anterior and the foremost of the posterior main trunk, *i.e.*, the third and fourth longitudinals, about the middle of the wing are connected by a transverse vein, the *vena transversa minor s. media*. Using this transverse vein as a starting point, we can have no doubt about the position of each of the six main longitudinal veins.

The remaining veins lie as follows:—The first of the four main trunks continues along the anterior border of the wing; it either runs round the entire border, attenuating towards its end, in which case it is called the *vena marginalis;* or it only reaches as far as the fourth or third, or even the second or first longitudinal vein, and is then generally called the costal (*vena costalis s. costa*); but both these expressions may be used as identical. The costal vein is sometimes interrupted in one or more places, thus forming several successive portions, a structure most characteristic of certain families. Besides the costal a second vein

sometimes springs from the first trunk, but as it is often absent this is not counted as one of the longitudinals but is named the auxilliary; not far from its base it is connected with the costal by a transverse vein, the *vena transversa humeralis*. A total or partial absence of the auxilliary vein, its structure, and the peculiarities of its situation with relation to the first longitudinal, are very characteristic marks for the distinction of families and genera.

The first and second longitudinals are usually simple, but in the *Culicidæ* the latter is always forked, while the third is often forked (though not so in the *Culicidæ*), an anterior branch springing from it, generally beyond the small transverse vein and running to the border of the wing between the second and third longitudinals. Between them lies the fork of the third longitudinal, and the part of the latter which lies between the small transverse and the point of bifurcation is called the handle of this fork or *pedunculus*. Sometimes this anterior branch is connected with the second longitudinal by a transverse vein, or runs into the second longitudinal instead of to the border of the wing, and thus has the appearance of being a transverse vein.

In most *Diptera* including the *Culicidæ* there is no connection between the third and fourth longitudinals except the small transverse; but in some families, the fourth, altering its direction towards the end, turns towards the third longitudinal and reaches it, either at its end or a little before it, thus forming a second connection.

There is a rarer case in which such a connection is made by a transverse vein distinctly placed on the fourth longitudinal vein. A third connection between the fourth longitudinal and the anterior main trunk is formed, in some families, in the neighbourhood of the base of the wing, but often there is only a transverse fold running obliquely between the fourth and first longitudinal veins. In some families it thickens into a distinct transverse vein. The three longitudinal veins springing from the second main trunk usually diverge close to the base of the wing; the hindmost being often plainly its continuation, while the fifth and fourth, uniting at their bases, form a kind of loop which touches the

main trunk at one point only. As frequently, however, it is the fifth that forms the continuation, and in some families, all three appear with equal distinctness as its branches. Between the fourth and fifth longitudinals there are in general two transverse veins, which divide the space between them into three areas. The first of these transverse veins is called the anterior basal (*vena transversa basalis anterior, s. venula basalis anterior*), the absence of which is characteristic of certain families including the *Culicidæ*. The second is usually the largest of the transverse veins, and is of great systematic value. It is called the posterior transverse, or *vena transversa posterior sive venula posterior*, and is represented in that family.

Not unfrequently another vein starts from its middle and runs to the border of the wing, but it cannot be counted as a longitudinal, and so is called the anterior intercallary (*vena intercalaris anterior*). It must not be confounded with a branch, which springs, in some *Diptera*, from the hinder side of the fourth longitudinal before its tip.

Near the base of the fifth longitudinal rises the posterior basal transverse (*vena transversa basalis posterior s. venula basalis posterior*), usually a short transverse vein running to the sixth longitudinal, but often meeting it only at a later portion of its course at a very acute angle, or even failing to meet it and reaching the border of the wing free. In any case it divides the space between the fifth and sixth longitudinals into two parts. In several families, another vein, the posterior intercallary (*vena intercalaris posterior*), arises from the fifth longitudinal, immediately beyond the posterior basal transverse and runs to the border of the wing; but sometimes it meets the fifth before reaching the border of the wing.

Behind the sixth longitudinal are the branches of the fourth trunk. They are entirely wanting in many *Diptera*, and in the *Culicidæ* are represented only by an indistinct incrassation of the wing membrane unprovided with fringing scales, and in most are only rudimentary, only one, or at most, two weak branches being represented, and these not reaching the border of the wing. When present they

are named axillary veins, and when well developed they form complete longitudinal veins, and may be numbered as the seventh and eighth without fear of misunderstanding. Where thus developed the seventh is generally connected with the sixth by a transverse vein. It results that the anterior part of the wing is divided by the three anterior longitudinals; and the posterior part, by the three posteriors, each into three sections, an exterior, a middle, and an interior one, and the two groups of sections are separated from each other by a middle stripe or band extending from base to tip of the wing.

The terminology of the various spaces appears, in many cases, ill chosen, but any change from the accepted nomenclature would involve too great initial confusion to be advisable. The cells of the first sections of the wing then are called the costal (*cellulæ costales*); of the second, the marginal (*cellulæ marginales*); and of the third, the sub-marginal (*cellulæ sub-marginales*) cells. The last have the greatest systematic importance. When the second and third longitudinals are simple, it follows that there is only one sub-marginal cell; but when the third has a branch running to the border of the wing, two cells, an anterior and a posterior are formed; and when the anterior branch of the third is also connected with the second by a transverse vein, the number of sub-marginal cells is raised to three; of which that formed by the inner part of the anterior sub-marginal cell is called the interior. When, however, the anterior branch of the third longitudinal takes the form of a transverse vein, running to the second, only an interior and exterior sub-marginal cell are distinguished.

The nomenclature of the middle of the wing and of the first two posterior sections is in an unsettled state, and some of those most valuable for systematic work have been too little noticed, *i.e.*, those near the base and costa. Of the former three are important. All three are situated nearest to the base of the wing; the first of them belongs to the middle area or stripe, and reaches as far out as the small transverse vein; the second belongs to the first of the posterior sections, and is limited externally by the anterior

basal transverse vein; and the third belongs to the second posterior set of sections, and is bounded on its outer border by the posterior transverse basal. They may be called the anterior middle and posterior basal cells. When however, the posterior basal transverse, instead of joining the sixth longitudinal, runs to the border of the wing like a longitudinal, it is difficult to find a suitable name, and though the term is ill-chosen it will be well to retain the name of "anal" for this cell, as it is too well established to be easily altered. Its use is often extended to cases where the hinder basal, though closed, is exceptionally long owing to the posterior transverse basal vein being placed unusually far out. In certain families there is a great and symmetrical development of the three basal cells, and in such cases they are often denominated the *cellulæ ternatæ*, but though expressive enough, it is clearly a superfluous nomenclature.

Another important cell is the discoidal, which is placed in the middle of the three areas into which the space between the fourth and fifth longitudinals is divided by the anterior basal transverse and posterior transverse veins. When the anterior basal transverse is wanting, which is characteristic of many families and genera, this cell coalesces with the second basal, which must then be considered as part of the discoidal cell; if, on the other hand, the posterior transverse vein be wanting there is no discoidal cell at all.

In those *Diptera* which possess the anterior intercallary vein, occasionally the part of the posterior transverse situated before or behind the intercallary is wanting. In such cases the existence of a discoidal cell is assumed, and it is considered as open in front in the former, and behind in the latter instance.

The distal portions of the middle space between the two main trunks, and of the posterior sections, are called the posterior cells, and are numbered from before back, beginning with the former. Although, strictly speaking, there are but three such cells, they may be subdivided by intercallary veins, and by the fourth longitudinal emitting a hinder branch, so that the total number may reach six, and the established usage is to number them consecutively. divisions and sub-divisions indifferently.

When, owing to the absence of the posterior transverse vein, the second posterior and discoidal cells are fused, it retains the name of second posterior. The cells belonging to the third hinder section are generally not completely separated from each other, and are then called false cells (*cellulæ spuriæ*). They are numbered from the sixth longitudinal to the posterior angle of the wing.

Reverting to the anterior sections, we find that the space between the costa and auxiliary vein is divided into two cells, the first and second costals, by the humeral transverse vein. Together with the space between the auxiliary and first longitudinal vein they form the three costal cells, counting from the base. Lastly, the space between the first and second, and second and third longitudinals are called the marginal and sub-marginal cells respectively.

For the rest, the *incisura axillaris*, a retiring angle in the outline of the wing in its axillary border near the base, and the alula, a lobe appended to the wing between the axillary incision and its base, alone require special mention. The latter, however, should not be confused with the covering scale that lies above the halteres, as is a not uncommon mistake.

A complete nervation is often easier to make out than an incomplete one, but, in such cases it is well to remember that the incompleteness is due to the scanty development of the anterior veins, and to their being crowded up close to the costal border of the wing.

The legs of *Diptera*, like those of other Orders, consist of four principal parts, the hips or *coxæ*, the thighs or *femora*, the shanks or *tibiæ*, and the feet or *tarsi*. Of these, the coxæ consist of two joints, the smaller second joint being called the trochanter; the femur and *tibia* each of a single joint; and the feet, generally, of five joints, of which the first is sometimes called the metatarsus. At the tip of the last joint are two claws (*ungues*), and under each of them there is generally a membranous appendage called the pulvillus; many families having, in addition, between the pulvilli, a third appendage of similar structure called the

epipodium, while, in other families this appendage is bristle like or altogether wanting.

Loew's nomenclature, as given above, will suffice to render easily understood the great majority of the descriptions of the *Culicidæ* that follow, at any rate, as far as concerns every part of the insect except the wing; but here the variety is most confusing, as it is hard to find any two authors that follow the same system, many adopting names based on fanciful resemblances to points of vertebrate anatomy, instead of the simple numerical terms employed above, while even those that employ numbers to indicate the veins and cells make use of different numbers to indicate the same vein.

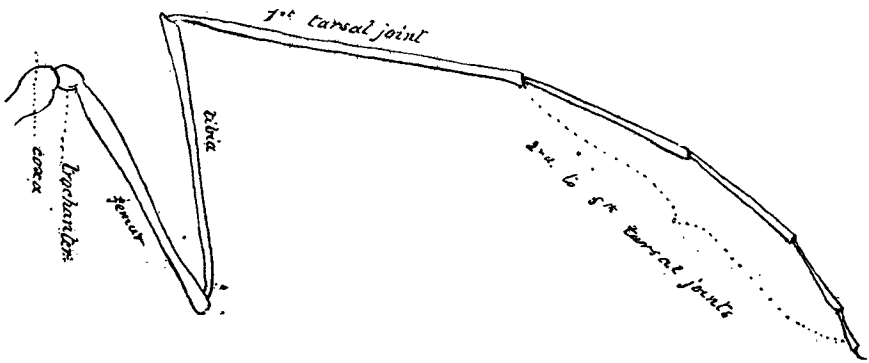


FIG. 3.—LEG OF A MOSQUITO.

It is no doubt extremely desirable that the terms employed should be the same for all insects, but there are endless differences of opinion as to the correspondence of the veins in the different families, and too often authors insist on introducing these abstract views into the nomenclature in which they describe species instead of waiting till there is some approach to agreement on the question. Even Loew, it will be noted, is not content with numbering the longitudinal veins from the costal backwards, but interposes an "auxiliary" between the costal and the first, on the ground that the former is so often absent, but the same

reason would abolish numbers altogether. The latest contribution to the subject is Mr. Austen's "How to Collect *Culicidæ*," issued by the Authorities of the British Museum, but this, although beautifully simple, differs in some points from Loew's, and does not appear to be employed in any of the descriptions of the family that I have as yet met with. In Mr. Austen's system, Loew's "auxiliary" is called the mediastinal vein, a term employed also by Thomson; and two wing-folds, unprovided with fringing scales, are included in the enumeration, and are placed between Loew's fifth and sixth, and beyond the latter respectively. The foremost of these being numbered as the sixth, Loew's sixth becomes Austen's seventh, and the other the latter's eighth longitudinal. Then again Mr. Austen's anterior is Loew's middle transverse vein. Skuse, who is responsible for most of the descriptions of Australian *Culicidæ* mostly follows Loew, but introduces the additional term of "supernumerary" transverse to indicate the abruptly angulated connection of the third with the second longitudinal, but, as this is often so oblique as to deviate but little from the general direction of the vein, it certainly seems simpler to regard it as does Mr. Austen, as merely the root of the third longitudinal. Still, in many cases, the third longitudinal of Mosquitoes is undoubtedly continued inwards to the root of the wing, in the form of an unscaled wing fold, and if this represent the normal, Skuse's view of the transverse character of the vein must be regarded as correct, especially as in wings denuded of their scales by brushing, "this wing fold" is often as sharply defined as any other portion of the system of veins. On this account, when not merely transcribing, I have followed Skuse's nomenclature in this particular, and because it is in actual use in the description of a large number of species.

Another term employed in many of the descriptions which require some explanation, is to speak of the spaces enclosed between the branches of the second and fourth longitudinal veins, that is to say, the first sub-marginal and the second posterior cells, as the anterior and posterior "fork cells" or "fourchettes" respectively, and these terms

are certainly most convenient in describing the wings of gnats. Ficalbi speaks of the longitudinal portion of the third longitudinal vein as the "vena interposita."

Where names are used instead of numbers to denominate the longitudinal veins, the first is commonly called the "post-costal," the second the cubital, the third the submarginal, the fourth the marginal, the fifth the brachial, and the sixth the anal, while Mr. Austen's eighth longitudinal would be spoken of as the axillary.

Without pretending to disentangle the confusion of the nomenclature of the Dipterous wing with any completeness, the above notes will, I believe, suffice to enable the reader to follow the existing descriptions of the family under consideration in the great majority of cases, more especially as in the larger number the wing is left practically undescribed.

PLATE I.—To Illustrate the Anatomy of the Imago.

Fig. 1.—The general arrangement of the digestive system: *c*, palpi; *e*, antennæ; *g*, "gizzard," or muscular dilatation of the œsophagus; *h*, so-called aspiratory vesicle; *i*, salivary glands; *j*, œsophagus; *k*, "stomach"; *l*, large intestine; *m*, Malphigian tubes; *p*, rectum; *q*, rectal glands.

Fig. 2.—Diagram of the nervous system: *a n*, antennal nerve; *o l*, ophthalmic lobes; *s g*, supra-œsophageal ganglion, or brain; *s b g*, sub-œsophageal ganglion; *t g*, mass consisting of the third thoracic and first dorsal ganglion; *a g*, abdominal ganglia.

Fig. 3.—The female generative organs: *a*, tracheæ; *b*, ovaries; *c*, ligament to parietes; *d*, ovarian duct; *e*, oviduct; *f*, spermothecæ; *g*, last abdominal ganglion; *h*, genital nerves; *i*, lobes of ovipositor.

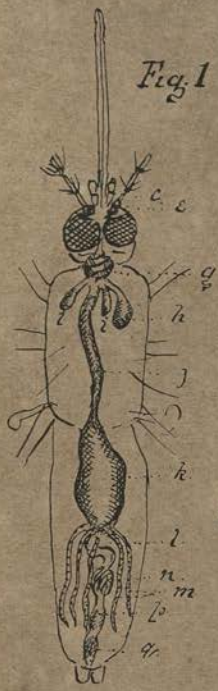
Fig. 4.—The male genital organs; *a*, testes; *b*, vas deferens; *c*, vesiculæ seminales; *d*, ejaculatory duct; *i*, penis; *f*, claspers; *g*, internal hypopygial lobes.

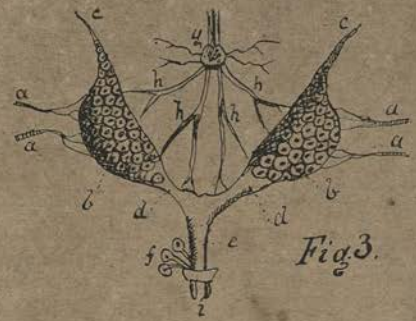
Fig. 5.—Muscular dilatation of digestive tube, within the mouth.

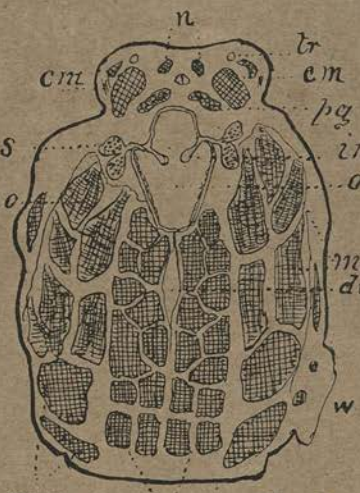
Fig. 6.—Transverse section through the posterior part of the abdomen of a hibernating female: *d v*, dorsal vessel; *pvs*, perivascular space; *o v*, ovary; *r*, rectum; *m*, Malphigian tubes; *g*, last abdominal ganglion. × about 100 diams.

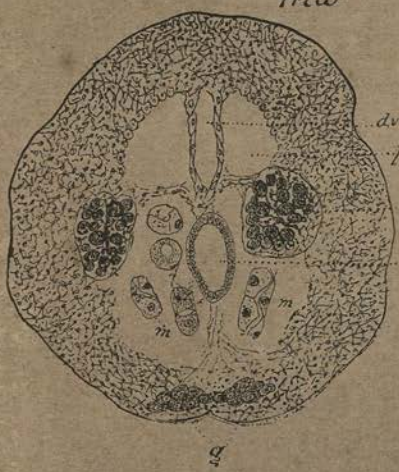
Fig. 7.—Transverse section of the thorax of a hibernating female; the ventral side is placed uppermost: *n*, ventral nerve cord; *tr*, trachea; *c m*, muscles of coxæ; *p g*, poison gland; *s*, salivary glands; *i n*, chitinous, valve-like involution of wall of œsophagus; *o e*, œsophagus; *m o*, oblique muscular fibres; *d v*, dorsal vessel; *r*, root of wing; *m w*, wing muscles; *m l*, longitudinal muscular bundles. × 170 diams.

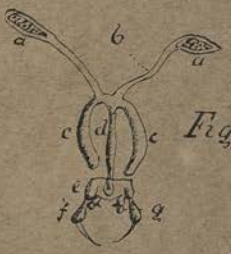
Fig. 8.—Various forms of scales: *a*, common form; *b*, marginal wing scale; *c*, scale from *C. tæniorhynchus*











Bale and Danielsson, Imp.

CHAPTER II.

The Anatomy of the Mosquito.

In its anatomy the Mosquito conforms to the usual insect type, the body being divided into the three sharply separated regions of the head, thorax, and abdomen; the first accommodating mainly the organs of sense, the second, those of locomotion, and the third, the digestive and reproductive organs.

The head is rounded, but wider than long, and bears the usual appendages, all of these being represented, although those forming the mouth parts, being modified to form the style-like proboscis, differ markedly from the ordinary insect foot jaws, and present perhaps an even wider divergence from the simpler forms, than the suctorial mouths of other *Diptera*.

In this region of the body no sign of segmentation can be made out, nor is there any visible separation between the dorsal and ventral chitinous shields, such as is found in the other regions of the body.

The greater part of the sides and front of the head are occupied by the facetted eyes. These are always large and well developed and, in certain species, may even touch each other in front. Their anterior border is usually somewhat hollowed back to lodge the bases of the antennæ, so that they tend to a reniform outline. There are no ocelli, or simple eyes, such as are found in the majority of *Diptera* and, though some authorities assert that they are present in a rudimentary form, I have not been able to satisfy myself as to the existence of any trace of them in the adult insect, and for practical purposes, at any rate, they may be considered as absent.

Immediately in front of the eyes will be seen the antennæ. These are of the moniliform type and, although of fundamentally similar construction, differ greatly in appearance in the two sexes, owing to the organ in the male being so richly provided with long, silky hairs as to form a pair of singularly beautiful plumes; while in the female these hairs are less numerous and down-like, so that the joints of the antennæ itself are plainly visible, and are the portion of the organ that catches the eye. In both sexes the antenna is formed of fourteen joints, the basal one of which is much the largest and of globular form, the constriction at its base being fused with the cephalic shield so as to be capable of little, if any motion. The greater part of the front of this large basal joint is occupied by a soft, but tightly stretched membrane, and into the centre of this is articulated the base of the second joint, which, like those that follow it, though but little shorter, is not one-fifth of the diameter of the basal joint. The chitinous wall of the latter is grooved on its interior for a richly developed system of nerve threads which are symetrically arranged in its lining membrane like the wires of a birdcage. The structure of this joint has been described in great detail by Dr. Christopher Johnstone of Baltimore, U.S. *Quart. Journ. Micros. Science*, iii., pp. 97-102), and he contends that the entire antenna serves as an auditory organ, the atmospheric vibrations being received by the long hairs of the antenna, and so transmitted to the drum-like membrane which, as already described, closes the front of the basal joint, and thence through its contained fluid, to the nerves lining its cavity. According to this theory the anterior membrane is an actual *membrana tympani*, and the fluid within corresponds in function to the endolymph contained in the cavities of the internal ear of the higher animals. It has been further pointed out that the hairs of the verticils of the male Mosquito respond to the musical note formed by the vibrations of the wings of the female insect. Professor Lubbock ("The Senses of Animals," p. 115) seems to regard with some favour Johnston's ideas on this point, but antennæ having this form of basal joint are not very common in insects, and if it be really a tympanum it is

certainly a very exceptional arrangement. The articulation between the first and second antennal joints is capable of very free motion, so that at this point the entire organ can be moved to a considerable angle in any direction, while the extent of mobility between the latter and the succeeding ten joints is much more limited. From the second to the twelfth pieces inclusive, the joints closely resemble each other, forming a moniliform series of short cylindrical pieces of a length but little exceeding their thickness. From the base of each springs a verticil of hairs, numerous (about forty) and long in the ♂, and shorter and fewer in the ♀. It is more than probable that these hairs in the ♂ are really chordotonal, auditory organs, as there is no doubt that they respond to the note of the female wings, and it is the function of the male in these insects to seek out the female, but the acceptance of this does not involve that of Johnston's theory of a tympanic function for the basal joint. The last two joints greatly exceed the others in length, forming together much more than a third of the entire length of the organ. The basal verticil of the penultimate is well developed, but that of the last is ill-developed, and both are closely covered with short, downy hairs, and exhibit also certain pits and specialised hairs which probably are sense organs, olfactory, tactile, &c. For further details on the sense organs of insects, the reader is referred to Lubbock's work, already quoted. Projecting from the middle of the head (*vide* Plate V., fig. 10), below the antennæ, is the characteristic proboscis which, although it at first sight appears to be merely a cylindrical, trunk-like projection, is really a very complex organ, being composed of no less than nine separate pieces. The organ springs from a sort of groove on the lower aspect of the head, through the intervention of a flexible membrane, which admits of a certain amount of protrusion and retraction as well as of flexion and extension in the vertical direction. In the first place, the front of the head is prolonged into a long styliform organ, the *labrum* or upper lip, which extends nearly to the tip of the organ. Beneath it and lodged in its groove is a long, pointed cannula, the hypopharynx, forming a sort of exten-

sion of the pharyngeal tube. On either side of these are two lancet-shaped pieces, the mandibles and maxillæ, the latter being the more delicate, and provided at their ends with a number of spine-like barbs. Lastly, beneath all is a sheath which completely encloses the other parts, except along its upper border where it is open. This sheath is the lower lip or labium, and is generally thickly clothed with scales and hairs and somewhat dilated at its end into a pair of jointed, more or less spatulate valves, which are homologous with the labial palps of masticatory insects.

When the Mosquito brings the proboscis into action to pierce the cuticle of the plant or animal from which it seeks its food, all these parts except the sheathing labium are forced into it, while the labium is bent down into a sort of loop which progressively narrows as the piercing organs penetrate more and more deeply. On either side of the base of the proboscis may be seen a pair of jointed appendages, the maxillary palpi. These organs have been described by several authorities as labial palps, but a closer examination shows that they are really connected with the base of the maxillary lancets through the intermediation of a piece which, in the usual position of the parts, is hidden within the base of the labium. In most cases the palpi consist of five visible joints, but they present great sexual and generic differences within the family, and require especial notice, as the classification of these insects is largely based on their characteristics.

In some species they greatly exceed the proboscis in length, while in the genus *Ædes* they are quite rudimentary in both sexes and appear to consist of only a single short joint. The head is connected with the thorax by a soft flexible neck corresponding to the intersegmental membranes of the abdomen, and which allows of a considerable freedom of movement between these two divisions of the body.

The thorax is the most bulky portion of the body, as, though but little broader than the head, it is more than twice as deep. It is composed of three segments, but the great preponderance of the middle of the three, or meso-

thorax, and the fact that the three are fused together into a single rigid mass, makes it not altogether easy to make out the lines of division between the component parts. Viewed from above, almost all that is visible is the tergum of the mesothorax, but in the genus *Psorophora* a portion of the prothorax can be made out in the form of a pair of lateral protuberances, the shoulder callosities, and on either side of the scutellum, which appertains to the mesothorax, can be seen, even in the extended insect, a portion of the better developed metathorax, while in flexion, the whole width of its tergum can be easily seen. On the pleural aspect, however, the three component segments are easily distinguishable by the fact that each gives origin to a pair of legs, the coxæ of which guide the eye to the corresponding portion of the thorax. Just in front of the root of the coxa of the front leg can be seen, in the great majority of species, an oblong or oval scale, which covers the stigma of the prothorax. In the genus *Psorophora* of Desvoidy this stigma is much — even more completely protected, while in *Megarhina* they are especially large but quite unprotected.

The stigma of the mesothorax is also well developed, and can easily be made out just in front of the origin of the wings; but those of the metathorax, on the other hand, are generally difficult to make out and may be atrophied. From the propleura springs the coxa of the front leg, and between it and that of the middle leg is a comparatively large area of mesopleura. This latter is more or less divisible into three areas, one of which carries the stigma; the second the middle leg, and the third and hindmost the wings. From the metapleura springs the coxa of the hind legs, and above it may be seen the halteres or poisers, a pair of small, club-like organs, consisting of a delicate stem terminating in a pear-shaped head, which is considered to represent the rudiment of the hinder wings of other orders of *Diptera*.

There appears to be good reason for regarding these modified wings as sense organs, for although mere rudiments, as far as their original functions are concerned, they are supplied by one of the largest nerves in the body, and have

been regarded by Keller, Hicks and Bolles Lee as auditory organs.

According to the last-named authority ("Les Balanciers des Diptères," *Recueil Zool. Suisse*, 1885), the organ consists of a varying number of rows of minute vesicles, placed at the base of the organ, each vesicle being perforated and containing a minute hair. Sense organs have been discovered in a variety of very unexpected situations in insects, and it is quite possible that, while the verticillary hairs of the antenna of male gnats may serve as chordotonal organs, whereby they are enabled to localise the whereabouts of the female; ordinary hearing may be subserved by these peculiar structures at the base of the halteres.

Almost the whole of the interior of the thorax is occupied with the powerful muscles that actuate the wings, legs, and halteres, but the detailed consideration of their arrangement hardly lies within the scope of a work like the present.

The general structure of the Dipterous leg and wing have already been sufficiently alluded to in the remarks on the terminology of the Order, but, as regards their special characteristics in the Culicidæ, it may be noted that the former are always proportionally long and slender, and that the hips, or upper sections of the coxæ take the form of obconical processes, immovably connected with the corresponding pleuræ; while the trochanters are much smaller, and take the form of short globular, or oviform pieces. Of the remaining joints, the femur, tibia, and first tarsal joint are long and linear, and, as a rule, differ but little in length, and their relative proportions furnish valuable specific indications. Not unfrequently the first tarsal is the longest of the three. The remaining four tarsal joints taken together do not, as a rule, equal either of the above linear joints, and generally progressively diminish in length, the last being often quite cubical, and carrying a well-developed epipodium and pulvillus, and a pair of claws. These last are nearly always proportionally well-developed, and though often quite simple, are as frequently provided with one or more strong accessory teeth. Moreover, the external and internal claws may differ in form, one being provided with

an accessory claw while the other is simple, and it is exceptional for the claws of all three pairs of legs to agree in form. Varying as they thus do, there can be no doubt but that the form of the claws would, if generally noted, be capable of furnishing valuable specific indications; but though valuable notes on this point have been made by Ficalbi, and also by Arribálzaga, information on this point is wanting in the great majority of species, and the circumstance that it is impossible to properly make them out without mutilating a specimen by mounting the legs for the compound microscope tends to render these characters not so useful as others for the practical purposes of classification. The legs are always thickly clothed with scales, and in one or two species of the genus *Sabethes* of Desvoidy, the sides of the tibiæ and tarsi of certain legs are provided with lateral fringes of long hairs so as to form a sort of paddle-shaped expansion.

The third division of the body or abdomen is the longest of the three, but is much more slender than the thorax. It is more or less cylindrical, but depressed, being broader than deep, and is composed of nine segments, none of which are provided with locomotor appendages, although the last bears a pair of jointed appendages which serve as the external organs of generation. Each segment is composed of a dorsal and a ventral rather rigid, chitinous plate, united at the sides by a softer membrane in which are placed the stigmata or external respiratory apertures. The anterior segments closely resemble each other, except the first, which is a good deal shorter than the rest. The last three, however, are shorter and diminish rapidly in width; and the last two are specially modified to accommodate the apertures of the digestive and reproductive systems, the anus being placed on the ventral aspect of the eighth segment, while the tergum of the ninth is quite invisible in the usual position of the insect, and all that can be seen of it are two lobed appendages, thickly clothed with hairs and scales, and not showing any very prominent difference in the two sexes. In both they consist of a pair of olive-shaped protuberances, but in the male, instead of ending in a simply rounded, bristly extremity, they have articulated to each a strong

incurved claw, by which the female is grasped during copulation, the whole organ forming a clasper. In the female they are somewhat spatulate and act as an ovipositor, and, held together, form a sort of channel along which the ova are passed on to the upper surface of the similarly held together hind tarsi, by which they are guided to the surface of the water on which they are to be launched.

If we dissect the abdomen by teazing with needles or by sectionising, we find that immediately beneath the chitinous exoskeleton there is a soft, cellular layer, the true dermis; and beneath this again, a very scanty and interrupted layer of longitudinal muscular fibres, which not only serve as flexors, extensors and adductors, but can also, when simultaneously contracted, shorten longitudinally and therefore transversely widen the entire region, an action which cannot fail to have an effect in keeping in motion the air contained within the tracheal system. For, although there is no continuous, rhythmic action of the body comparable with the respiratory movements of the higher air-breathing animals, movements of this kind are sufficiently frequent and habitual to exercise a powerful action in preventing stagnation of the air contained in the respiratory tubes. These longitudinal muscles are arranged in sets, each set corresponding to an intersegmental membrane and serving to connect two adjacent segments. There are also a few transverse fibres, arranged mainly in two lateral groups, placed near the middle of the segments, but they are less easily made out.

Having now sketched the external configuration of these insects, their internal organisation remains to be considered, and will probably be best dealt with by taking separately the various systems, digestive, respiratory, and reproductive in their turn.

Starting from the base of the proboscis, and contained within the cavity of the head, the intestinal tube commences as a sort of pyriform chitinous dilatation, which is divided longitudinally externally into four sections, divided from each other by deep sulci. Behind this the canal becomes a simple cylindrical tube, and passes through the

aperture in the base of the occiput to enter the thorax, where it becomes dilated into a sort of muscular gizzard, which opens behind into a simple transparent tube, the œsophagus. Into the œsophagus, a little behind its commencement, open three structures, *viz.*, the aspiratory vesicle and the salivary and poison glands.

These and the rest of the digestive apparatus may easily be demonstrated by dissection in the following manner:—Take a specimen, and place it on a slide with a little salt solution, and carefully remove the legs and wings. Next tear open the thorax, so as to loosen the anterior attachment of the tube, and then carefully partially detach the last two abdominal segments by separating the delicate intersegmental membrane. Now place one needle so as to fix the last two segments, and with the other entangled in the thorax pull steadily on the anterior portion, when the alimentary canal and its appendages will be drawn out intact attached to the hinder fragment. If the operation be successful even the œsophagus and salivary glands will be included in the preparation, but, as a rule, the tube is torn just behind the latter, so that they and the suctorial bulb are left attached to the thorax.

Assuming however the preparation to prove a complete one, we find it commences with a narrow tube, which presently expands into a thickly walled, gizzard-like dilatation, which is supposed by some to be the apparatus whereby is exercised the suctorial power of the insect. Behind this is a short, constricted portion, which opens in its turn into a long, wide, soft-walled tube, the chylific ventricle or stomach.

Immediately after its commencement, the œsophagus receives the ducts of three structures. Of these the two smaller are the two salivary glands, which consist of a pair of short cæcal tubules. These are somewhat broader at their free blind extremities than at their point of attachment to the œsophagus, and are lined with a glandular epithelium consisting of rounded or cuboidal cells. In addition to the salivary glands proper a third gland, of very similar structure, can be made out. This is the poison

gland which secretes the irritating fluid which the insect injects into the puncture it inflicts on its victim, and which is supposed to have the power of preventing the coagulation of the blood it draws. The termination of its duct is doubtful, but it is believed to fall into the base of the hypo-pharynx, though in certain figures I have seen this so-called duct looks suspiciously like a trachea. The remaining structure is a large vesicle, with delicate walls, filled with large air-bubbles, the so-called aspiratory vesicle. That it is constantly attached to, and generally comes away with, the digestive canal is a matter about which there can be no doubt, but personally, I must confess that I doubt greatly if there be any communication between its cavity and the lumen of the œsophagus. If pressure be made on the cover glass of a temporary preparation, under no circumstances can the contained air be forced from it into the œsophagus, and indeed, for all practical purposes it appears a closed sac, although it seems likely enough that there is some communication between it and the numerous large tracheæ that are distributed on its walls. I have as yet been unable to make out any such connection, but if such exists, the apertures of communication are probably extremely minute, and would be only visible if brought into relief by staining, a process to which the cyst wall does not lend itself in the case of any of the stains I have experimented with, in the few trials I have as yet made. Apart from these considerations, it is difficult to understand on what physical principle such a structure can subserve the function ascribed to it.

It is conceivable that a thick walled structure might, by elasticity, after muscular contraction tend to dilate, and so originate a condition of negative pressure within its cavity, but the wall, in this case, is of extreme tenuity, and even could such a negative pressure be produced, it could only be communicated to the proboscis through the intervention of a rigid tube, which in this case, admittedly, does not exist, for the soft flexible canal of the neck connecting the head with the thorax would at once collapse under the pressure of the external air, if any

lower tension existed within the intestinal canal in the thorax. It does indeed appear not impossible that the peculiar, melon-like buccal bulb contained within the head, already noticed, might be capable of exercising some such function, but no such hypothesis is in any way necessary to account for the suctorial powers of the insect, as, in view of the extreme tenuity of the canal through which the food of the animal is drawn, capillarity alone is amply sufficient to account for the facts of the case. Moreover the *Culicidæ* are by no means the only suctorial insects, and whatever its function, no such structure is found in other suctorial families, and unless we regard the crop for storing pollen of the *Syrphidæ* as of the same character, it is quite unique among the *Diptera*. For these reasons, I am disposed to regard this peculiar structure as having either a pneumatic function, or being in some way connected with respiration.

After a short course, the œsophagus opens into the stomach, which forms by far the largest part of the intestinal canal. It is of considerable width throughout, but especially so at its hinder end. Throughout its entire length it is thrown into deep transverse folds, which recall somewhat the *valvulæ conniventes* of the higher animals, and probably serve the same purpose of increasing the secretory area. In insects that have but recently emerged from the pupal stage some remnants of the last predatory meal of the larva may occasionally be seen, but in the well-established imago plant juice or blood will alone be found. Lastly, succeeding the broad, hinder part of the stomach, comes the hind gut, and running into the junction of the two are seen opening four long, convoluted, dark-tinted glandular bodies, the Malphigian tubes. These are supposed to have an excretory function, and as uric acid and other renal products have been found in them, the balance of opinion regards them as renal organs. They are lined with a series of large nucleated cells, the protoplasm of which is exceptionally rich in pigment and granules. These cells are arranged in a somewhat peculiar fashion, for as they are too large to admit

of their forming a complete lining, the cell of one side projects into the depression formed between two consecutive cells of the other side, so that in a tube that has been a little flattened out by pressure the lumen appears zigzag, and the individual cells roughly triangular.

The last part of the digestive canal is much narrower than the stomach, its lining epithelium smaller celled and of a less glandular character, and its wall thick and muscular, while around it may be distinguished some strands of voluntary muscular fibre springing from the wall of the penultimate segment. Occasionally, especially in the male insect, the anal glands, consisting of a pair of small vesicles with some fine glandular tubes opening into their necks, can be made out, but more commonly these remain entangled in the tissues of the hind portion of the abdomen, which forms part of such a preparation, and they cannot be distinguished.

The respiratory system is quite of the usual type and presents no noticeable peculiarities, the main trunks from the stigmata giving off communicating branches to those in front and behind them, and ending in a tuft of branches for the supply of the muscles and other organs contained within the segment. There are, of course, no stigmata in the head or in the last abdominal segment, and the two anterior thoracic stigmata are by far the largest and most important in the body, the abdominal openings being individually small and difficult to make out, as they are completely hidden by the scales fringing the edges of the sterna and terga. They are placed rather nearer the front than the back of the segments, and are best demonstrated by first carefully removing all scales by brushing, and then crushing the insect as it lies on its side between cover and slide, so as to pinch the abdomen from side to side and bring the lateral surface into view beneath the microscope. The circulatory and nervous systems also present no peculiarities, beyond the few points that will be found noted in the section on the anatomy of the larva and its metamorphoses.

The genital organs of the female consist of a pair of more or less spindle-shaped bodies, which, in the unimpreg-

nated insect, are contained mainly in the last abdominal segment, and lie obliquely in it on either side of the middle line, their distal extremities being supported by a sort of libament springing from the common fibrous lining of the segment. They contain a large number of soft closely-packed ova in various stages of development, those nearest the opening of the oviduct being the most advanced. They are richly supplied with tracheæ, supplied from the stigmata of the penultimate segment, as well as with large nerve threads from the last abdominal ganglion. The ovaries communicate with the common oviduct by means of a short, transparent, funnel-shaped tube, and this latter is a short transparent canal, which, commencing in the junction of the funnels of the ovarian ducts, runs straight backwards without convolution or deviation from the middle line, to open between, and at the base of, the ovipositors. Just before its external termination, it receives on either side the ducts of three small glandular bodies, each consisting of a spherical glandular portion and a short neck or duct. They are filled with an opaque white fluid, which appears black to transmitted light, and, in the opinion of Arribálzaga, serve alike as spermothecæ and as accessory glands for the production of the gummy fluid which cements together the eggs to form the masses in which they are deposited.

After impregnation, the ovaries increase greatly in size, the contained ova attaining such dimensions that the entire abdomen appears filled with them; and indeed, in pregnant insects the outline of the ova, which are relatively of exceptionally large size, can often be made out on external inspection of the abdomen. When nearly ripe for expulsion they appear to be united in groups consisting of from four to six rows. Each egg is a somewhat elongated body, one of the poles of which is clear, while the other is granular and semi-transparent, and is provided with a sort of club-shaped appendage.

The male generative organs consist of a pair of small yellowish bodies, the testicles, from which the sperm is carried by the vasa deferentia, which are simple straight tubes, to the ejaculatory duct which originates in their

union. Just before the termination of the vasa deferentia, they receive the ducts of the receptacula seminales. The ejaculatory duct is short, simple and straight, and ends in a short, fleshy penis, which is unprovided with any chitinous armature.

All these points can be made out, if not at the first attempt, at least after a few carefully made, teazed preparations, and the reader is strongly recommended to follow the preceding descriptions with such preparations before him rather than to trust to illustrations, which, owing to the extreme delicacy of the objects which it is attempted to represent, are at best mere diagramatic representations, and afford but little real help in the recognition of the parts sought for.

PLATE II.

Bale and Danielsson, Imp.

PLATE II.—To Illustrate the Anatomy of the Larva.

Fig. 1.—Full-grown larva of *Culex annulatus*: *a*, respiratory syphon; *b*, swimming fan; *c c c c*, anal papillæ.

Fig. 2.—An antenna, more magnified.

Fig. 3.—Respiratory syphon more enlarged, to show: *a*, the muscles; *b*, the valve-like terminal lobes; *c*, the stigma.

Fig. 4.—Segmental respiratory apparatus: *a*, part of the main longitudinal trunk; *b*, lateral branch; *c*, cord by which the cast-off lining of the tubes is withdrawn during ecdysis.

Fig. 5.—Left mandible, seen from below.

Fig. 6.—Right maxilla, seen from below: *a*, internal lobe; *b*, external lobe; *c*, maxillary palp.

Fig. 7.—Labium, with the lower part of the pharynx, seen from above: *a*, the labrum itself.

Fig. 8.—One of the natatory compound bristles, much magnified.

Fig. 9.—Thorax of larva of *C. pipiens*, to show: *h*, the hepatic masses; *i*, intestine; *t*, main longitudinal tracheæ.

It will be noticed that in this species the thoracic dilatation of the tracheæ is by no means so marked as in *Cannulatus*, and the whole respiratory system is less developed.

This plate is partly based on Meinert's figures, and partly original.

CHAPTER III.

The Anatomy of the Larva.

FROM a purely anatomical point of view, a good deal has been written on this subject, but, on the descriptive side, comparatively little has been recorded, so that, except in the case of a few of the commonest species, we are quite without adequate descriptions whereby Culex larvæ may be distinguished among themselves. In by far the greater number of recorded species the larvæ have never been recognised, and still less described. It is obvious, however, that as these insects can be much more easily destroyed in large numbers in the larval stage, by insecticides, or by the filling up of pools, than they can be as flying insects, the accurate description of the larvæ of noxious species has become a matter of great importance; but it is unfortunately one that can, as yet, be hardly said to be commenced. In this task, the minute arrangement of the bristles with which the larvæ are liberally provided will probably be found to afford the readiest points for recognition, but up to the present we can go no further than the recognition of genera, the distinctions between which, however, are sufficiently marked.

The larvæ of all the *Culicidæ* are aquatic, and are encephalous, *i.e.*, have a well developed head. When just hatched, the larvæ are of just sufficient size to be easily seen by the naked eye, and are at this stage so transparent, that almost all details of their anatomy can be made out in the living larva placed under the microscope in a little water. If all superfluous water be carefully removed from beneath the cover, by means of a strip of absorbent paper, so as to slightly press upon without crushing the larva, its

naturally vivacious movements will be sufficiently restrained to admit of its being observed at leisure.

The larvæ are easily recognised by their vivacious wriggling movements, as minute worm-like bodies, with a disproportionately large head with a pair of prominent black eyes, and what, at first sight, appears to be a sort of vertically bifurcated tail, and being quite without any signs of legs, swim by means of the strokes of a tail armed with large expansions of bristles, not unlike that of a lobster in form. When more closely examined, it is seen that, like the adult insect, it consists of three well-defined regions, the head, thorax, and abdomen. Commencing with the head, it is seen to be not quite so wide as the thorax, but considerably wider than the abdomen, and forms a truncated cone, wider than it is long, and separated from the thorax by a distinct sulcus. It is ornamented on the dorsum with several patches and lines of pigment, the arrangement of which differs in different species. And, at the broadest part, laterally are placed the two large eyes; and it is further ornamented in various places with tufts of strong bristles, the structure of which is often very complex.

From two slight prominences, a little in front of the eyes, spring the antennæ, and projecting from the middle of the anterior border of the head may be seen a complex arrangement of bristles springing from the upper lip and mouth parts.

The greater part of the upper surface of the head is formed by the dorsal surface of the third metamere. In front of this is the clypeus or dorsal plate of the second metamere, a short but broad plate, with a shallow, curved indentation in front, while laterally it is armed with a pair of incurved tufts of bristles which form what Meinert (De Eucephale Mygelarver) speaks of as a whorl, or rotatory organ; as he believes that it is by the vibrations of these bristles that nutritive particles are directed into the mouth. Anterior again to the clypeus is a small, rounded, median prominence, the labrum or dorsal plate of the first metamere.

The eyes are large and placed laterally forming a sector of about 150°, and close behind them may be distinguished a minute ocellus, generally of oval form. The antennæ spring from the antero-external corners of the third metamere, and form a pair of short, curved horns, fairly freely movable on their basal articulation with the head, but elsewhere rather rigid. The greater part of the organ consists of a rather stout basal joint, which is provided at the inner side of its distal extremity with a tuft of strong compound bristles.

The next joint is less than half the length of the basal, and is distally armed with a few long, stiff bristles, while, like the basal joint, it is beset throughout its length with stiff, short spines. The last portion of the antenna or flagellum is very minute, although there are indications that it is in reality composed of three very short articulations. Besides the flagellum there are also attached to the end of the second joint two peculiarly formed processes or jointed hairs, which are almost certainly sense organs of some sort, and are most probably olfactory organs.

In general form the thorax forms a sort of six-sided box, and is somewhat larger than the head in all dimensions.

Although no sutures can be distinguished on its surface, its division into its three component segments is sufficiently indicated in its outline, and by three pairs of lateral tufts of bristles, which are longer and stouter than those of any other region of the body. The component hairs of these tufts are all compound, each being clothed throughout its length with filaments of considerable proportional length; and each tuft springs from a nipple-shaped tubercle, which appears to be capable of a certain amount of voluntary movement, though, from its position, it is obviously not the rudiment of a leg. These tufts appear to act by way of lateral keels, whereby the larva is maintained in any position without being made to revolve on its axis under the influence of the strokes of the tail. In addition to these principal tufts, other smaller but also pedunculated tufts spring from the sides of the terga of the segments, the characters of which should be accurately noted in

describing species, as it is probable that their form, number and position may yield good specific characters. The great preponderance of the mesothoracic segment is already well marked, though not to anything like the same extent as in the imago.

Proceeding with the examination of the living larva, the first thing that catches the eye are four pairs of what at first sight appear to be pigment spots. A little watching, however, suffices to show that these are not really external markings, but internal organs seen through the transparent carapace, and that their position is constantly altering under the action of the surrounding thoracic muscles, and of the pulsations of the dorsal vessel. Examined with a somewhat higher power, they are seen to be glandular bodies of a sacular form, lined with secretory cells, their cavities being filled with a clear fluid, holding in suspension a quantity of deep-brown granular matter. These glands are connected with the upper end of the intestine, and are probably hepatic in function. In the dead, or preserved and mounted larva, they soon become invisible, owing to the discharge of the contained brown matter into the intestine.

These glands are arranged in two sets, an internal and an external, the former of which consists of two glands placed so closely together as often to look like a single mass, and situated nearly in the middle of the thorax, close to the intestinal canal. The other two pairs are placed at a distance from the intestine, in the corners of the pro- and metathorax respectively. In the middle line the dorsal vessel can be seen pulsating, the action being rather that of a peristaltic wave than a true systole, the heart being here a long, valved tube, corresponding rather to an aorta than to a heart in the usual acceptation of the word.

More or less in the middle line, too, its coarser image often obliterating that of the delicate, superjacet dorsal vessel, is the stomach, or chylific ventricle, its opacity varying with the fulness of its contents; and on either side may be seen the dilated thoracic portions of the respiratory tracheæ, which are easily distinguishable by the

spiral thickening of their chitinous lining, while branches of the tracheal system to the various organs can be traced in various directions.

The abdomen is about six times as long as the thorax, but much more slender, and consists of nine segments, each of which is provided with a large tuft of bristles as well as with numerous hairs, either single or grouped, on the dorsal and ventral surfaces. The cardiac, intestinal, and respiratory tubes can all be traced through the greater part of its length, and the Malphigian tubes, and other intestinal appendages can all be made out, as the larva takes favourable postures. The nervous system, however, is completely hidden, and owing to its transparency during life, cannot be seen even if the animal be placed in the supine position.

In the genera *Culex* and *Mochlonyx*, there springs from the dorsum of the eighth segment a large process, at least as wide and two or three times as long as the remaining segment of the abdomen, and into this the two main respiratory trunks can easily be followed, and are seen to open at its extremity by means of curiously guarded openings. At the root of this breathing horn are a pair of rather short but dense tufts of hairs. The last segment contains the rectum and carries the anal tubercles, the anus being placed almost at the very extremity of the body, but rather towards its ventral aspect. Around the opening are two pairs of delicate, leaf-like expansions, each furnished with a branching twig of trachea, the lower pair being somewhat the larger. They probably act as gills, and subserve respiration during the periods when the larva is completely submerged, which, when the weather is cool are often somewhat protracted. On either side, too, but originating a little in front of these anal tubercles, are a pair of large dense tufts of compound hairs, which are employed in swimming much in the same way as the swimmerettes of the lobster, and are so arranged as to form an expansion of similar shape.

The internal organs are of typically insect plan, and will be most easily understood by considering each system separately.

Digestive System.—Apart from the gnathites or foot-jaws which, although of the ordinary masticatory type are rather complex organs, the intestinal canal is of the simplest form, consisting of a narrow œsophagus, which leads into a wide, perfectly straight tube, commonly spoken of as the stomach, which extends to the end of the sixth abdominal segment. Into its thoracic end open the ducts of the hepatic glands, which have already been sufficiently described, and into its distal, where the tube contracts before the commencement of the rectum, open the five Malphigian tubules, which are slender tubular glands, differing in no way from those of the adult. Lying close to the œsophagus in the thorax are the two salivary glands, but they are not easy to demonstrate, except in section, and the same remark applies to the rectal glands, which lie beside the rectum in the last segment. The mouth parts consist of an upper lip or *labrum*, in the form of a convex crenated plate, armed with numerous hairs, and a longer and narrower lower lip, or *labium*, of somewhat similar structure. Between these are placed the two pairs of foot-jaws, the mandibles above and the maxillæ below. Each mandible consists of a somewhat pyriform plate, the wider end of which forms an articulation with the lateral structures of the mouth; while the narrower end is formed into a rather complex set of dentations divided into two groups, the anterior of which are small and claw-like, and mainly adapted for holding the prey, while the hinder set are better adapted for cutting and crushing. The appendage is further provided with brushes of peculiarly formed hairs, and has, about the middle of the anterior border, two large jointed processes or hairs which probably are tactile or gustatory in function. The maxilla is a plate of somewhat quadrangular outline, the anterior border being curved and its corners rounded off. It is richly provided with hairs, some of which have a curiously compound structure, and, from its inner and posterior corner there projects a short, three-jointed maxillary palp in the form of a truncated cone, the extremity of which is armed with minute spines. The above description should suffice to enable the dissector to recognise the various parts, but it

would be wasted labour to enter into minuter detail in a general description, as the form and arrangement of the various parts differ somewhat in the various species, and the minutiæ will best be studied by teazing out the parts from the head of whatever larva happens to be available, with needles under the simple microscope.

Respiratory System.—This is very highly developed in these larvæ, and presents many peculiarities which differ widely in the different genera; and hence the remarks below must be understood to apply to *Culex* only. The two main longitudinal tracheæ are in all, however, of such large size that they may be considered rather as elongated air sacs than as mere tubes for the conveyance of air to the tissues.

Doubtless, they serve a double function, namely, as receptacles for the storage of air for use during periods of complete immersion, and as hydrostatic organs to secure a proper degree of buoyancy. It is only the two main longitudinal trunks that are so largely developed, the remainder of the tracheal system being of no more than the usual complexity in organisms of this sort. Each of these main trunks commences quite abruptly in the prothorax, and, rapidly increasing in diameter, attains its largest dimensions in the mesothorax, where, in some species, *e.g.*, in *C. nemorosus*, there is a marked local dilatation; in *C. pipiens*; however, there is no mesothoracic dilatation, and the tube remains of nearly the same diameter throughout the entire length of the abdomen to its termination at the end of the peculiar dorsal process of the eighth segment. The anastomoses between the two main stems are trifling, there being only two transverse connections placed in the pro- and mesothorax respectively before the tubes have attained their maximum diameter. The anterior of these two cross-branches is considerably the larger, and immediately in front of it each trunk splits up into a number of branches, which enter the head and are distributed to the various organs contained in it. The large anterior cross branch gives off no branches, but the hinder one supplies some twigs to the wall of the intestinal canal, and to the hepatic

glands. From each of the main trunks in the thorax there issue also three rather large branches, one for each segment, which divide up into branches that pass to the contained muscles and viscera. Between these lateral thoracic branches I have not been able to make out any longitudinal communication; but like the lateral abdominal branches they extend as pervious tubes nearly to the skin of the larva, and are continued to the latter as an impervious chitinous cord, surrounded by true dermic tissue to actually blend with the external chitinous covering of the larva. In the abdominal region the arrangement is essentially the same, only here there is a continuous longitudinal anastomosis between the lateral branches, one of which issues from the main trunk of all but the last segment, and after a short course divides into three main branches; an anterior to anastomose with the posterior branch of the lateral trachea of the segment in front of it, a posterior to communicate with that behind it, and a continuation, which after distributing branches of air supply is continued to the skin, first as a pervious tube and then as an impervious cord, exactly as in the thorax. These cords represent the rudiments of the future segmental stigmatic trunks of the imago, and it is by their agency that the discarded lining of the portion of the tracheal system belonging to the segment is withdrawn from the body whenever the larva undergoes its periodical change of skin. From these three principal segmental branches there issue branchlets which carry air to the various muscles and viscera of the segment. These lateral stigmatic cords can best be studied in the abdominal region; and if a cast skin, such as will be found floating in abundance on the surface of any vessel in which larvæ are kept, be carefully examined, it will be seen that the main longitudinal air sac has broken up into segmental lengths, and that each piece is attached by its cord to the skin of the corresponding segment; for it must be remembered that not only the outer skin but the whole of the lining of the tracheal system is thrown off at each ecdysis. The structure of the peculiar dorsal horn of the eighth segment remains to be described. Each of the two main stems

passes up through it separately, to end in a pair of stigmata at its extremity, whose openings are considerably smaller than the diameter of the tube, being placed in the centre of a small circular plate supported by chitinous rays. The mechanism by which these openings are protected from the entry of water is rather complex and consists of a sort of valve, formed by five flap-like lobes at the end of the process. These flaps consist of two pairs and a small unpaired lobe, the larger of the two pairs being placed opposite the small unpaired one. Between the two air tubes, and around them, are a number of muscular strands, which originate in the eighth segment and extend through the process to be inserted into the bases of the flaps, so that, when they contract, the stigmata are drawn down somewhat within the process, and the valves close over them.

Vascular System.—This consists of a delicate, long wide tube, which extends along the dorsal aspect of the body, from the hinder part of the head to the very extremity of the abdomen. Its structure is so delicate that, except in the living larva, where its shape and position can be followed by its movements, it is extremely difficult to make out. It consists essentially of a long, thin-walled tube, with valvular constrictions opposite the incisuræ, communicating freely with the perivisceral spaces, by means of cribriform appertures, which, however, are anything but easy to demonstrate. There is no system of peripheral vessels at all comparable with those of the higher animals, the function of the organ being to keep in motion the perivisceral fluid, which is thus kept flowing over the tracheæ which lie free in the perivisceral spaces, between the various organs and tissue elements. It acts, in fact, rather as a churn than as a pump. In front of the thorax it extends as a narrower vessel into the head, and this portion is sometimes spoken of as the "aorta," but I look upon this term as a misnomer, as, save in diameter, the extension differs in no way from the rest of the dorsal vessel, is quite unprovided with branches, and appears at its anterior end to lose itself in the general interstitial lymph spaces of the head. The circulating fluid

is colourless and contains but few cellular elements, those that are present being of the nature of leucocytes, so that while fulfilling the functions of both, the fluid is rather of the nature of lymph than blood.

Nervous System.—The demonstration of the nervous system can only be made by dissection, as its elements are too delicate to be distinguished from the overlying intestine, even in the supine position, and for this purpose specimens hardened in alcohol are best. Even thus it is not altogether easy to follow out any length of the chain, and for those who will be satisfied to examine a closely allied larva, it is recommended to dissect the larva of one of the *ephemeridæ*, in which the nerve cord can be separated with singular ease. These larvæ are very common in grassy pools and small running streams, and may be recognised by their long caudal bristles, which give them the appearance of possessing a long forked tail. When one has become accustomed to what to expect to see by practice on these easier subjects, it will be found easy enough to teaze out the nerve cord in *Culex* larvæ. In the head, however, this is scarcely practicable by the method of teazing, and sectionising must be resorted to. Taking the young larva as a type, a pair of ganglia can be demonstrated for each segment, and on emerging from the thorax the lateral cords separate to pass backwards across the œsophagus, to combine behind it in the large supercesophageal ganglion or brain. From this mass filaments are given off to the eyes and antennæ, and from it, as well as from the ganglia of the segmental chain, fibres pass to the corresponding muscles, and to the periphery, sensory filaments having been actually traced into the bases of the hairs. At the time of pupation the location of the ganglia undergoes changes of startling rapidity.

Mr. F. V. Theobald, in his "Rough Notes," mentions that in a few minutes prior to the escape of the pupa from the larval skin the first abdominal ganglia come to lie in the posterior part of the thorax, and during pupal life the changes are equally rapid. In four days the fore-brain increases tenfold in bulk, the first abdominal ganglia fuse with the three thoracic pairs, and about the same period

the eighth pair shift forward and fuse with the seventh ganglia, and in the ♀, but not in the ♂, the double mass so formed shifts into the sixth segment. This last alteration is performed with remarkable rapidity during the few minutes the imago takes in emerging from the pupa case.

Organs of Sense.—The eye in the encephalous larva is usually stated to be of the "simple type, consisting of a group of ocelli with lens and retinal expansion."

This sort of statement has been copied from one text-book to another till it has become sterotyped, but as a matter of fact, there is neither lens nor retinal expansion, properly so-called, and the eye appears to be rather a transition stage in the development of the compound eye of the imago, than a structure in any way like the ocelli of adult insects, or the eyes of spiders or molluscs.

In full-grown larvæ of *Culex pipiens*, the eyes, although distinctly separated by an unpigmented gap, form for all practical purposes a single visual organ, the thick but perfectly transparent cuticle forming an unbroken spherical curve over both eyes, and although this is somewhat thicker in the middle line opposite the separation between the deeper parts of the eyes, there is nothing whatever in the form of a lens, at any rate in the optical sense of the word, as not only is its internal limit formed by the irregular surface of the pigment, but even taking this as a regular surface there is so little difference in the depths of the anterior and posterior curves that any image formed by it would fall nowhere near the visual nerve endings but somewhere in the animal's thorax. If we examine a not too thin radial section of the organ it will be seen that it consists of a number of conical masses of pigment, the combined bases of which form the inner boundary of the transparent cuticular layer of the eye, and into the apex of each may be traced a fibre of the optic nerve springing from a bilobed mass of ganglion cells, almost in contact with, but yet distinct from the large lobes of the cerebral mass.

Selecting a thinner section we find that each nerve fibril, shortly after starting from the optic ganglion, begins to acquire a rapidly thickening covering of pigment granules,

and that as soon as this has become sufficiently bulky to merge with the neighbouring sheaths of pigment to form the base of the great pigment mass of the eye; the fibre expands into a spindle-shaped body provided with a distinct nucleus. Beyond this the spindle-shaped body contracts into a rod-like structure, the actual ending of which I have not been able to trace, though I think it simply ends in the midst of the transparent contents of the tubular visual elements to be presently described. A further examination of radial sections shows that the pigment-covered sensory cones each consist of a deep portion enclosing the spindle-shaped bodies which may or may not be radial in direction, and may even be curved, and an outer portion containing the rod-like nerve end which is always truly radial. If we now turn to the examination of tangential sections, we find that the superficial layer of the general pigmented mass consists of a number of cylindrical prolongations of the transparent superficial layer of the eye, each enclosed in a layer of pigment, which is very thick at the surface and becomes gradually thinner as the deeper layer containing the spindle-shaped bodies is approached.

In all sections that are sufficiently truly tangential to afford a clear image, the contained terminal rod can clearly be seen as a well stained dot exactly in the middle of the transparent contents of the tube of pigment; but whether it extends through the entire length of the tube, or ends somewhere during its course, is more than I can say; in any case, however, it extends along it for some considerable portion of its length. From what has been said it is clear that the terminal rods can receive only rays, the direction of which is parallel to the radius of the sphere of the eye coinciding with the transparent axis of the pigment-clothed visual element, and that such rays will reach this end-rod and no other, so that although there be no dioptric apparatus such as is found in each visual element of the facetted eye of the adult insect for the purpose of concentrating on the contained rod the pencil of rays entering each transparent cylinder, it is, nevertheless, like such eyes, suited only for mosaic vision, and is for such a purpose, only less efficient in

so far as in that a smaller portion of the entering pencil of rays will actually reach the end-rod placed in the axis of the transparent cylinder. Indeed, to complete the development of the eye of the imago no great alteration of the deeper parts is required, but only the modification of the transparent superficial layer of the eye into the beautiful system

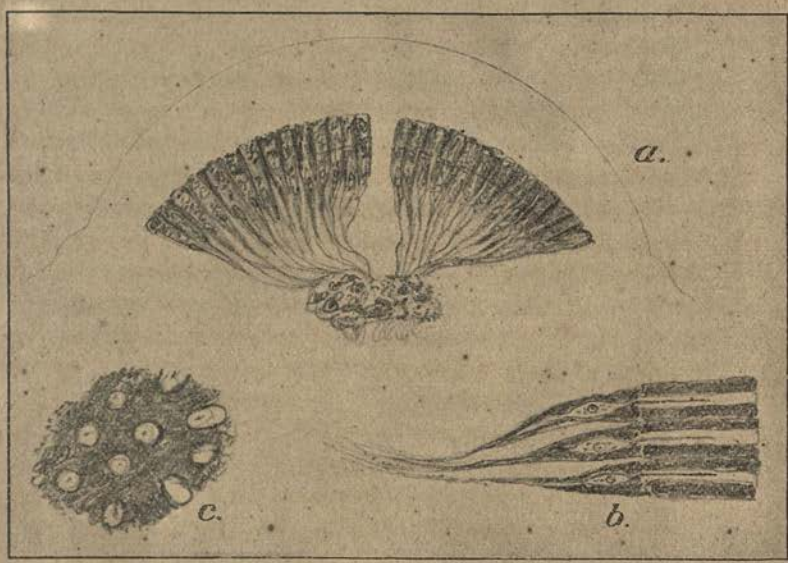


FIG. 4.—TO ILLUSTRATE THE ANATOMY OF THE EYE OF THE LARVA.

a, Radical section through anterior part of the head of the larva of *Culex pipiens* cutting through both eyes and the optic ganglia *b*, semi-diagrammatic representation of three of the visual elements of the above more highly magnified; *c*, portion of tangential section of the outer layer of the pigmented portion of the eye.

of miniature dioptric systems, one for each end-rod, which forms the most striking characteristic of the facetted compound eye. I have gone into somewhat more detail than usual in this point, because I have nowhere met with any account of the visual organs of these larvæ which appears to be based on actual observation of the family, most authors being apparently content to assume that their eyes

must needs resemble the visual apparatus of other and often very distant groups of invertebrata. It is clear that in such an eye the mosaic must be a very coarse one, and that, except in the case of very near objects, the impression gained of their form must be extremely fragmentary and ill-defined.

Hearing.—As regards the organ of hearing it happens that in one member of the family, *viz.*, in the larva of *Corethra*, an organ as to the auditory nature of which there can be little doubt has been studied in some detail. In this genus the larvæ are so transparent that they are known as glass larvæ, and hence can be studied with exceptional advantage, and the organ which is situated in the eighth segment is described and figured by Professor Lubbock in his popular work on the "Senses of Animals." In this form the ganglion which is placed in the anterior part of the segment gives off a branch, the auditory nerve, which after a short course outward expands into a small auditory ganglion from which a sheath containing two or three auditory rods passes outwards and backwards to the skin.

The auditory ganglion and end-organ are further supported and kept in a state of uniform tension by a ligament which runs in an opposite direction from the ganglion to the skin at the anterior part of the segment.

The organs of smell and taste are probably situated in the antennæ and maxillary palpi and other parts of the mouth respectively, but I am not aware of any papers on this subject bearing on the *Culicidæ* in particular.

DIFFERENT GENERA.

PLATE III.—TO SHOW THE CHARACTERISTICS OF THE LARVÆ OF

Fig. 1.—The larva of *Anopheles maculipennis.*

Fig. 2.—Hinder extremity of the same more enlarged.

Fig. 3.—The larva of *Anopheles nigripes*, to show the arrangement of the respiratory system.

Fig. 4.—Pupa of *Anopheles maculipennis.*

Fig. 5.—One of the natatory bristles.

Fig. 6.—The larva of *Corethra plumicornis.*

Fig. 7.—The pupa of *Corethra plumicornis.*

Fig. 8.—Embryo of *Corethra plumicornis* within the ovum.

Fig. 9.—The larva of *Mochlonyx culiciformis.*

Fig. 10.—The pupa of *Mochlonyx culiciformis.*

Eale and Danielsson, Imp.

CHAPTER IV.

The Generic Characters of the Larvæ of the Culicidæ.

THE number of species which have been followed through their complete metamorphoses is, as already remarked, very small. In the case of the genus *Megarhina*, I can find no record of any observation whatever on this subject, while, in *Ædes*, the only note met with is one by Osten-Sacken, on *Ædes fuscus*, an American species, and this is of the most cursory description, all that is said being that they exactly resemble the larvæ of *Culex*, except that they are smaller. Putting then aside, *Megarhina*, the larvæ of the various genera may be divided into two categories, according as to whether they possess a dorsal respiratory process to the eighth abdominal segment or not. In the first category are *Culex*, *Ædes*, and *Mochlonyx*: in the second *Anopheles*, and *Corethra*. Amongst those possessing the respiratory dorsal process, the larva of *Culex* has already been sufficiently described; of *Ædes*, nothing more can be said, and of those sufficiently described, only the larvæ of *Mochlonyx* remain to be described. I have not been able to obtain for personal examination any other larvæ than those of *Culex*, and the notes given below are almost entirely a *précis* of Fr. Meinert's paper "De eucephale Myggelarver," (Videnskr. Selsk., 6, Raekke, Naturvidensk, og mathem. Afd. iii. 4.)

Genus *Mochlonyx*.—Meinert's remarks apply in especial to *M. culiciformis*, which formed the subject of his investigations. The full grown larva is of a light brown colour, the tracheæ and air sacs often shewing through the skin with a golden lustre. On the dorsum of the thorax are several small, dull white spots, and the pleuræ and venter are whitish. After each change of skin the colour

is almost white, and this lighter colouration persists longer on the head and anal tube than elsewhere, so that the newly-dressed larva presents quite a distinctive appearance.

In many points, these larvæ are intermediate in form between those of *Culex* and *Corethra*, but the head is most like that of *Anopheles*, forming like it a truncated cone, but differing, in being pinched in; in front of the eyes, so as to present a pyriform outline; and seen from the side the difference is even greater, as the tergal plate of the second metamere is bent downwards and then backwards, so that the anterior part of the clypeus overhangs the mouth. The tergum of the third metamere is cordate, being deeply incurved in front for the reception of the hinder part of the clypeus. The eyes are placed well back on the broadest part of the head, and are of oval form, with the long diameter transverse. The antennæ consist of a single joint, are moderately long and thick, and when at rest are directed downwards so as to be scarcely visible from above: they are provided with several jointed bristles, some of which are longer than the antenna itself. The labrum is almost rudimentary.

The mandibles are strong and trenchant, and, in addition to their teeth, carry a variety of simple and compound hairs, some of which are of very specialised forms. The maxillæ are short, broad plates, with a sinuous anterior border and stumpy, conical palps. They and the lower lip, in addition to ordinary hairs, are provided with several ranks of peculiar flattened bristles with truncated dentate ends.

On the maxilla, the inner face of the external sinuosity is provided with a single row of these peculiar plates, but on the labrum, which is transversely oval, there are three, and on the lateral plate of the metamere, with which the maxilla articulates, no less than five ranks of different lengths. They look as if they were designed to act as a sort of sieve to exclude too coarse materials from the mouth; but, as the larva is predatory and subsists mainly on small crustaceans, they are more probably retentive organs. The thorax is relatively very large, somewhat

flattened, and no distinction between its component segments is visible. The lateral tufts of balancing bristles which are so marked in *Culex* and *Anopheles* are ill-developed. The abdomen is cylindrical, slender, and of nearly uniform diameter as far as the seventh segment, the segments also progressively increasing in length up to this point, while the last two are of insignificant dimensions. The seventh, which contains the two large posterior air sacs, is of very exceptional size, being at least as long as any other two segments. The eighth segment, as in *Culex*, bears on its dorsum the respiratory process, but this is quite small as compared with the organ in that genus, and is of conical form. The ninth segment carries four small slender anal tubercles, and a pair of swimming fans composed of closely arranged, multifid bristles. The tracheal system is peculiar, combining many characters of these organs in *Culex* and *Corethra*. The main longitudinal trunks have the same course and general distribution as in the former genus, but are quite small, the hydrostatic function being fulfilled by two large pairs of dilatations or air sacs, which are situated in the thorax and seventh segment respectively. All four, and especially the thoracic sacs, are so large that they quite overshadow the rest of the tracheal system, the main trunks being reduced to the rank of mere communications between them.

The pupa closely resembles that of *Culex*, but the abdomen is relatively shorter and stouter. It may be most easily distinguished by the disproportionately large size of the seventh segment, which retains in the nymph the proportions it holds in the larva. The respiratory trumpets are small and somewhat olive-shaped.

Genus *Anopheles*.—Meinert's description refers in particular to *An. maculipennis*, with shorter references to *An. nigripes*. The ground colour of the larva is a light yellowish green, with a dark brown stripe along the back, which however is whitish in the middle line. There are also four small dark spots on the hinder border of the anterior abdominal segment, and six small, oblique bands

on the sides of the other segments. The head is less rounded than in *Culex*, and the constriction between it and the head is less marked than in that genus, so that it forms rather a truncated cone, with the broader part behind, than a sphere. The tergum of the third metamere is in the form of a lozenge, with the anterior corner cut off and the point behind, and is ornamented in front with six plumed bristles, the outer of which are the largest. That of the second metamere is broad and short, and carries at each of its outer corners a single plumose bristle. As in *Culex*, it is provided at its outer part with a dense whorl-organ. The labrum, which is tongue-shaped and crenated on either side, is small and hirsute. It is, moreover, overhung by the clypeus, so that it is little in evidence when viewed from above. The eyes form a band of pigment of somewhat pyriform outline, with the narrower end backwards, and on their outer sides are the small ocelli.

The antennæ generally resemble those of *Culex*, but are armed with a row of short, stout spines along the inner border of the basal joint. They carry also certain fan-shaped and other specialised bristles. The mouth parts closely resemble those of *Culex*, but the whorl-organs are larger. The lower lip forms an equilateral triangle, with a few strong dentations on its sides, and is prolonged into a peculiar dentated process, besides which, as seen from below, it is partly covered by two plates which appear to be connected with the ventral plate of the second metamere, which last structures do not appear to be represented in the other genera. The mandibles and maxillæ also closely resemble those of *Culex*, but the latter have a straighter anterior edge, and are less cut off at the corners. They are fringed with bristles, some of which are of a specialised character, and from their outer posterior corner there springs the maxillary palp, which is larger and more acutely conical, and also carries certain specialised bristles Proportionately to the head the thorax is a good deal larger, and exhibits three rows of bristles besides the large lateral tufts, the posterior of which are the largest in the

body, while those of the pro- and mesothorax are of insignificant size. The abdomen is cylindrical, and is very distinctly separated into nine segments, which increase in length, while they diminish in breadth from before back. The lateral tufts of bristles of the three anterior segments are exceptionally large, but the hinder ones are very small.

On the dorsal surface of the eighth segment are a pair of simply formed spiracles, which can be withdrawn beneath a fold of skin when the insect requires to protect their openings. The last segment carries the four anal tubercles, which, as well as the tail-fans, are rather less developed than in *Culex*. Although arranged on the same general plan within the body, the tracheal system is much less developed, the main longitudinal trunks being of very ordinary size, and quite without hydrostatic dilatations in any part of their course.

The pupa differs from that of *Culex* only in the respiratory trumpets being shorter and more squarely cut at the end. It may be distinguished from the pupa of *Mochlonyx* by the fact that the eighth instead of the seventh abdominal segment is disproportionately long. In the particular species examined by Meinert the pupa, like the larva, is grass-green, but this coloration is not universal in the genus.

Genus *Corethra*.—The species examined by Meinert were *C. plumicornis*, and *C. pallida*. The larvæ of this genus differ markedly from those that have been already described, and resemble those of the *Chironomidæ* rather than any of the *Culicidæ*. These larvæ are well known as favourite objects for microscopic demonstration of "pond organisms," and are generally known as "glass" or "crystalline" larvæ on account of their extreme transparency, which is broken only by the four darker, but still transparent air sacs placed in the mesothoracic and seventh abdominal segments respectively. The head is much smaller than in any of the preceding genera, being narrower than any other part of the body, except the last two abdominal segments. Its hinder half is bounded by straight parallel sides, as seen from above, but is contracted

in front, so that as a whole it presents the outline of a broad-nibbed pen. The eyes are small and round, and are placed well back on the head, rather on the dorsal aspect of their sides, and behind each of the large eyes is a single separate ocellus.

The antennæ are articulated, as it were, at the point of the pen and are relatively small. Each consists of a single joint with a constriction, followed by a small node just beyond the base, and is armed at the end with five large bristles, which spread out like the claws of a lizard.

The tergum of the third metamere is rudimentary, but its ventral plate forms the greater portion of the under surface of the point of the pen, and is provided about its middle with a sort of tubercle, from which radiate five pairs of large bristles, while behind this are a pair of peculiar fan-like plates, the posterior border of which is fringed with fine hairs. The ventral plate of the second metamere is generally spoken of as the labrum. It forms a sort of ridge in the middle, and is provided with a number of flattened hairs; on either side are a pair of projections carrying a number of strong radiating bristles, the analogue of the whorl-organ of the other genera. The mandibles are very large and trenchant, and being capable of very wide abduction are particularly well adapted for seizing the larva's prey. The maxillæ are two small, very simple plates, and the lower lip can hardly be said to be represented as such.

The thorax is much the stoutest part of the body, is of fusiform outline, and shows little or no indications of its component segments; both it and the abdomen are provided with only a few small compound bristles. The abdomen is composed of nine segments, which progressively increase in length to the seventh. These are of nearly equal width to the sixth, after which the body rapidly tapers off. The anal tubercles and swimming fans are small, but round the anus are four bristles of much greater size. Round the anus also are several ranks of peculiarly shaped hooks.

The respiratory system is peculiar. Apparently the

function must be entirely aquatic, as in the very young larva there are no signs whatever of tracheæ, and even in the fully-grown creature there are no stigmata or external breathing apertures whatever. In young larvæ all that can be seen are the two pairs of air sacs, which are situated in the same positions as in *Mochlonyx*, but present a very different appearance as they contain no air, but are full of serum and are lined with a large-celled epithelium with prominent nuclei. Gradually, with successive changes of skin the main longitudinal trunks and their branches appear piecemeal. At first they are full of serum, but as development proceeds they gradually fill with air, which, however, must be secreted from the blood, as there is at no period of larval life any direct communication with the exterior.

The pupa in this genus is distinguishable by the relatively large size of the abdomen and the small dimensions of the cephalo-thoracic mass. As far as its respiratory arrangements are concerned, however, it closely resembles the pupæ of the other genera, the breathing trumpets being well developed, with very oblique openings.

PLATE IV.—To Illustrate the Anatomy of the Pupa (after Hurst).

Fig. 1.—Side view of the male pupa.

Fig. 2.—Ventral view of the female pupa, partly extended.

Figs. 3-6.—Successive stages in the metamorphosis of the epithelium of the hinder part of the stomach.

Fig. 7.—Sagittal section of a very young female pupa. *Ant.* antenna; *Ao.* aorta; *At.* respiratory syphon; *B.* buccal chamber; *CG.* cerebral ganglion; *D.* gastric pouch; *F.* caudal fin; *Fe*^{1}. femur of first leg; *G.* ganglia; *Gn.* outgrowth of "ninth" segment, within which the gonapophyses develop; *Hr.* balancer; *H.* head; *Ht.* heart; *In.* intestine; *Lb.* labium; *Lbr.* labrum; *M.* Malphigian tubule; *M.Ap.* its opening into the intestine; *MS.* mesosternum; *Mt.* metasternum; *Mx.* maxilla (first); *Mxp.* its palp; *NC.* nerve commisures and ventral cord; *OC.* ocellus; *Od.* medium oviduct; *Op.* compound eye; *P.* prosternum; *R.* rectum; *S.* aperture of salivary duct; *SG.* suboesophageal ganglion; *Si.* larval respiratory syphon introverted into the eighth segment; *Sp.* spermatheca; *St.* stomach; *Ta*^{1}. *Ta.*^{2} proximal joints of the tarsi; *Ti*$^{1-3}$ tibiæ; *Tr.* trachea; *W.* wing; I. II. III. &c., first to eighth segments of the abdomen.

After the Plate in the late Mr. Hurst's Paper in the Mem. Owens Col. somewhat reduced.

Fig. 1.

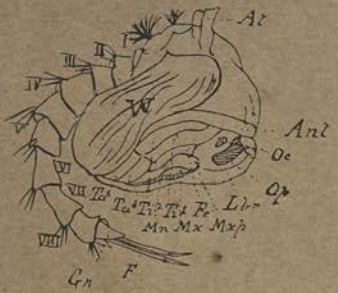


Fig. 2

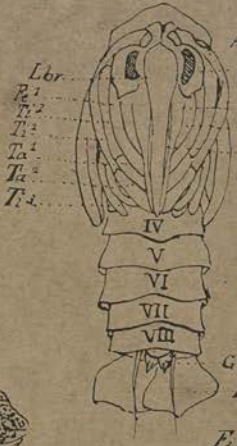


Fig. 3.

Fig. 4.

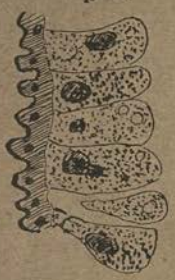


Fig. 6

Fig. 5

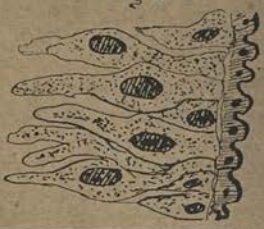
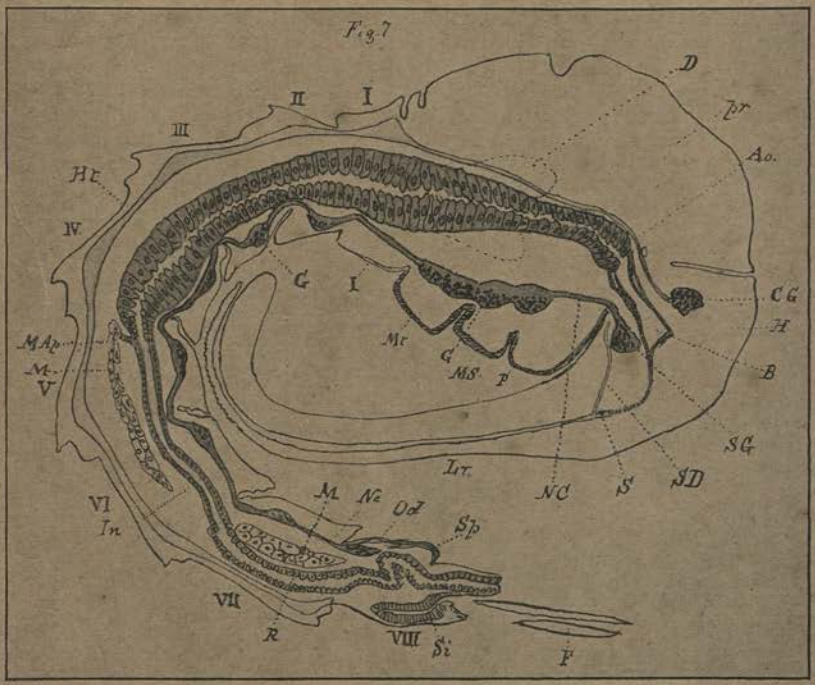


Fig. 7



Bale and Danielsson, Imp.

CHAPTER V.

The Anatomy of the Pupa.

THE following account is derived from the late Dr. C. Herbert Hurst's excellent paper on the subject, published in the "Studies from the Biolog. Lab. Owens College, II. 1890, pp. 47, *et seq.*"

The paper is too full to be reproduced in full in an introduction like the present, but is characterised throughout by the most painstaking accuracy, and I have been able to verify most of the statements reproduced.

During the latter stages of larval life, in addition to the visible head appendages, there appear eight other pairs beneath the larval cuticle. Of these six are thoracic and two abdominal. The thoracic pairs are three of them dorsal, the future pupal syphons, the wings, and the halteres; and three pairs ventral, the future legs. The two abdominal pairs belong to the last two segments. Those of the eighth lie in the larval syphon, and are to form the fins of the pupa; the hindmost pair form the outer gonapophyses of the adult, which are accessory organs of copulation.

All these eight pairs arise as foldings of the epidermis ("hypodermis") outwards, and are quite hidden under the larval cuticle. The antennæ too are much larger in an advanced larva than they appear to be externally, as the growing basal portion is folded, or even telescoped beneath the unyielding cuticle. Towards the end of larval life the animal becomes sluggish; profound changes in the mouth parts deprive it of the power of eating, and it floats with its breathing tube at the surface. Shortly, the cuticle bursts in the thoracic region, the pupal respiratory trumpets are protruded, the abdominal tracheæ appear to

collapse, and the animal floats with the anterior end upwards, the new syphons coming to the surface. The soft parts of the old respiratory syphon are withdrawn from the cuticle and invaginated into the eighth abdominal segment, while the lining of the tracheal trunks breaks up into pieces, which in the abdomen correspond to the segments, and is cast off with the other larval exuviæ by means of the mechanism that has been already described. The pupa, which thus escapes differs greatly from the larva. It is a little under 1 cm. in length when fully extended, and consists of a bulky, laterally compressed mass, made up of the head and thorax with their appendages, and of a slender flexible abdomen, which when at rest is carried curled under the thorax.

In a specimen 9 mm. long the thorax was 2·5 mm. and the abdomen 6·5 mm., but the thorax appears much longer on account of the wings which extend downwards and backwards from its sides. The head adds nothing to the length, as it is carried tucked down, under the thorax. It is broad from side to side, short from back to front, while ventrally it is drawn out into a long process, which extends backwards under the thorax as far as the anterior part of the abdomen, where it curves upwards. This process is made up of the mouth-parts, and includes all the parts represented alike in the adult and larva.

On throwing off their larval chitinous covering, the parts retain their larval masticatory type, but during the four days of pupal existence the various parts mould themselves and develop into the basis of the adult condition, so that by the time the chitin of the adult is ready for induration, they have altered their form to that of the adult mouth. From the sides of the epicranial region, the antennæ run outwards to the sides of the thorax, one beneath the anterior margin of each wing. The head and all its appendages are immovable during the pupal stage.

The thorax is rounded, but somewhat compressed from side to side. From the sides of its summit arise the respiratory syphons, a pair of conspicuous organs whose position and form has led to their being termed horns or trumpets.

The wings are nearly flat, oblong plates, arising behind the bases of the syphons, and extending downwards and backwards.

Immediately behind them are a pair of triangular plates, enclosing the halteres of the future gnat. The legs are mostly hidden by the wings, but the femur, tibia and first tarsal joint of the first leg, and the tibia and first tarsal of the second are visible. The respiratory syphons are nearly cylindrical, narrowed at their bases, and curved forwards to be attached by flexible membranes to slight prominences on the sides of the prothorax. Above, they are obliquely truncate and open, and the margin is slightly notched on the inner side. The outer surface is marked so as to resemble imbricated scales, each with a minute spine at its apex. The cavity of the syphon communicates directly with the tracheal trunk at its base. Palmén ("zur Morphologie des Tracheen systems," Helsingfors, 1877) has denied the communication of the syphons with the tracheæ, and imputed to them the function of "tracheal gills;" but apart from the fact that their dense chitinous structure renders them entirely unsuitable for the performance of any such function, the reality of their communication with the tracheæ can easily be proved by watching the imbibition of suitable fluids through the syphons into them. All these appendages originate as protrusions of the epidermic layer, enclosing mesoblastic tissue. Those of the dorsum are all at first flat, wing-like plates, but those of the mesothorax alone retain this form, as the wings of the adult, while the halteres become club-shaped, and the anterior appendages become rolled up to form the syphons of the pupa, only to disappear on attaining the adult form. The legs, on the other hand, appear from the first as cylindrical processes. They are at first unjointed, but by the end of the pupal period have segmented themselves into the various joints of the adult.

The abdomen is flattened dorso-ventrally, and when at rest is curved under the thorax. It is jointed and flexible, and forms with the pair of large fins, borne by the eighth segment, the only locomotor organ of the pupa, the wings

and legs lying immovable, and even adhering to each other, though they are easily separated in specimens preserved in alcohol.

Nine segments are easily recognised in the abdomen, and the last one, though it is probably composed of no less than three condensed and highly modified segments, is the smallest. Each segment has a chitinous tergum and sternum, and setæ are sparingly distributed over them, those present being mostly on the hinder part of the terga. Of these a pair placed on the hinder part of the first segment alone require mention. Each consists of a triangular basal plate, articulated to the tergum by a soft membrane, and distally divided into a number of bars, which by repeated sub-division give rise to about a hundred setæ, all lying in one plane parallel with that of the median of the body. When at rest the pupa floats with the tips of these setæ and those of the respiratory syphons at the surface of the water, and the setæ probably assist in maintaining equilibrium, as well as serving as sensory organs for the perception of disturbances of the water.

The eighth segment bears the fins, a large pair of thin oval plates about 1·2 mm. in length, each of which is strengthened by a midrib, which projects as a spine beyond its hinder border. Beneath and behind them is the ninth segment, a small though probably composite segment, which contains the anus, and is provided on either side and in front of it with a pair of blunt processes, larger in the male than in the female.

The digestive canal differs but little in any stage of the insect, the main change being the casting off of the thick large-celled lining of the stomach and the substitution of the more delicate mucosa of the adult. The cast-off larval mucous membrane appears to be disposed of by digestion. During this period also is developed the peculiar chitinous dilatation of the anterior part of the thorax, already described in the adult. Mr. Hurst describes it as triangular in section with incurved sides, to the concavities of whose sides are attached muscular fibres originating from the sides of the head, the mechanism being specially well developed in the

female. The peculiar air-containing sac already described is also developed at this time. It is obvious enough that the former mechanism is capable of being actively dilated by muscular action, and may therefore assist in suction, but it is difficult to understand how any one can have fallen into the error of ascribing such a function to the latter organ.

The circulatory system consists of a long dorsal vessel, which is broad and actively contractile in the abdomen and contracts into an "aorta" in the head and thorax. From its sides membranes, the *alæ cordis*, which serve to suspend it, run out between the extensor muscles and the stomach to attach themselves to the tracheal trunks. Each ala consists of a dorsal and ventral lamina, and the space between them has been called the pericardium. It contains the pericardial cells and communicates freely with the body cavity by the spaces between the alæ. There is no distinct constriction of the heart into chambers and the paired ostia or slits, which put it in communication with the "pericardium," open backwards in the first segment, and forwards and inwards in segments three to seven.

In the space between the *alæ cordis* are also the pericardial cells, which are brown in colour and arranged in ovoid masses, of which there are four pairs in each abdominal segment, two of which are in its anterior and two in its posterior portion. The protoplasm of these cells is extraordinarily spongy and contains numerous granules which stain deeply with borax carmine. The nuclei vary in number from 3 or 4 to 10 in each mass, but the boundaries between the cells cannot be made out. The excretory function of these cells has been shown by Kowalevsky ("Biolog. Central-blatt," ix., 1889) their function being probably somewhat analogous to that of the lymphatic and other ductless glands of the higher animals. I reproduce more fully the histological characteristics of these masses, as alike form their position close to the walls of the stomach, from which they are separated only by the ventral layer of the *ala cordis* and from their general appearance they might easily be confused with the parasitic "coccidia" of malaria recently described by Major Ross, I.M.S., by an observer not per-

sonally conversant with the appearances of the two structures; and I shall not be at all surprised to find descriptions of these bodies appearing in the form of notices of the occurrence of the parasites in the pupal stage. The possibility of the communication of the disease among mosquitoes through infected ova has already been mooted, and investigators working upon this line should be on guard against this fallacy.

The so-called aorta runs from the anterior end of the dorsal vessel forwards, above the stomach and œsophagus to the head, where it terminates in an open end. In transverse sections of the thorax the aorta appears as a laterally compressed tube, and does not appear to give off any branches.

The *respiratory system*, during pupal life, undergoes the changes which prepare the rudimentary stigmatic trunks of the thorax and abdomen to take on functional characters in the adult. With the exception of the first abdominal pair however, none of the stigmata are open except the prothoracic openings which form the respiratory syphons. These first abdominal stigmata open into the air space which exists under the pupal skin beneath the thorax, and in which the legs are undergoing development. This cavity must exercise a hydrostatic function, and the patency of these stigmata must be in this case necessary for the conveyance of air to the cavity. From the base of each syphon tracheæ run to various parts of the body and head. Among these may be mentioned specially one transverse trunk running across the thorax between the alimentary canal and the nerve chain, which puts the two syphons in direct communication with each other; and a pair of longitudinal trunks running back to the hinder end of the body, and giving off branches to the various organs, and also a branch to each of the future sigmata.

The cuticular lining or intima of the chief trunks and their branches is well developed even at the beginning of pupal life, and has the usual spiral thickening. The trunks connecting the stigmata with the main trunks are the only ones that undergo any marked change. These widen round

their separated and collapsed intima, and a new and strongly thickened intima is developed. In the main trunks no new intima is formed, and when the imago escapes no portion of the intima is shed, saving the portions connecting the syphons and the first abdominal stigmata with the main trunks. These fragments are, in the case of the syphons, well-developed, and have a fully developed spiral thickening. The portions connected with the first abdominal stigmata, though better developed than the other abdominal branches, have the spiral thickening only slightly developed. The terminal portion is beset with very numerous small spines.

The *nervous system* is particularly interesting. Within the short space of four days, certain ganglia increase enormously in size by the addition of cells, apparently derived directly from the epidermis; and other ganglia shift their positions bodily and sometimes fuse with others.

In the larva each of the first eight abdominal segments has a pair of ganglia; and yet a pupa, only half escaped from the larval cuticle, has four in the thorax and none in the first segment of the abdomen. During pupal life these four ganglia fuse into one compact mass. During the first two days of pupal life the eighth ganglia migrate into and fuse with those of the sixth segment. In the female the change goes further. A pupa almost ready to burst and give exit to the imago has still the arrangement already described; but an imago killed immediately after its escape is found to have no ganglia in the seventh or eighth segment, but in the sixth segment are two masses; the first the pair properly belonging to the segment, lying at its anterior end; the other a double mass, formed of the seventh and eighth ganglia, lying in the hinder end of the segment.

In the male imago the arrangement is the same as in the advanced pupa. In the head the supra-œsophageal ganglion increases enormously in size. The epidermal ("hypodermal") cells, especially those near the borders of the eyes, proliferate freely, and the cells budded off from their inner surfaces migrate inwards and form the new cells of the ganglia. By this process the ganglia, which at the commencement of pupal life were comparatively inconspicuous,

grow till they almost fill the head, and there are places in the advanced pupa where ganglia and epidermis appear continuous.

Dr. Hurst's paper also contains some very interesting details as to the development of the sense organs, especially of the eyes and antennæ; but for these the reader is referred to the original paper, as their interest is mainly that of the development of these organs in insects in general than that of the *Culicidæ* in particular.

Reproductive System.—The male generative organs of the adult consist of testes, vasa deferentia, "prostatic glands," copulatory organ, with a common pouch at its base and two pairs of gonapophyses. Of these last, the outer ones are a pair of large forceps for holding the female. Both pairs originate in the larva and are probably the appendages of two segments now fused and indistinguishable. The testes are a pair of cylindrical bodies, already present in the larva, at the sides of the intestine in the sixth segment. They are chambered and the spermatic elements in the hinder chambers are more advanced than those in front. The length of each segment is that of the segment in which they lie. The vas deferens of each side is a direct continuation of the wall of the testis, and is a very narrow tube running directly backwards, quite distinct from its fellow of the opposite side, but the two are closely bound together in their hinder parts and they open behind into the common pouch. The prostatic glands are a pair of elongated glandular tubes, apparently simple, but seen in sections to be double, though the cavities communicate behind before opening into the common pouch. This latter is a dilatation of the ejaculatory duct at the base of the copulatory organ, which last is perhaps derived from one of the component somites of the last abdominal segment, and represents its appendages. The hinder part of each vas deferens is, in some *Culicidæ*, expanded to form a vesicula seminalis of considerable size, but this is not the case in *Culex*.

The female generative organs are a pair of ovaries, the oviducts uniting behind to form a median oviduct, a median

copulatory pouch, and three spermathecæ, opening into the last. They correspond in size and position to the testes. The median oviduct is formed by the invagination of a region which Dr. Hurst takes to be the ninth sternum, while the anus opens at the posterior end of what he takes to be the eleventh abdominal somite, so that there is no common cloaca. This invagination is already far advanced at the beginning of pupal life, and during it it grows forwards, keeping pace with the forward shifting of the last pair of ganglia, and at all stages lying just behind it till the final ecdysis, when the rapid shifting of the ganglia leaves it behind. Its anterior end is, in the adult, near the front of the seventh segment. In the youngest pupæ three flattened invaginations, the future spermathecæ, lie on the dorsal wall of this median oviduct. During the pupal period the anterior end of each becomes spherical and acquires a strong chitinous lining. The anterior ends of these organs remain stationary in the eight segment throughout. The bursa copulatrix is a dorsal outgrowth of the invagination which gives rise to the median oviduct, and is a small pouch lying just behind and above the median aperture.

The pupa does not eat. It breathes air through the apertures at the end of its syphons. It floats, thorax upward, by virtue of the large air cavity lying under the hinder part of the thorax and front of the abdomen. This cavity is bounded in front by the legs, at the sides by the wings, and in front by the mouth-parts. It extends up at each side of the abdomen, where it is covered by the halteres, and into it opens the patent first abdominal stigmata. The pupa is sensitive to light, and immediately darts backwards when a shadow falls upon it suddenly. The movements, however, though very rapid, are devoid of anything like steering.

The larva has to search for food, but the pupa has simply to get out of the way of danger, and the direction of its flight is of little importance, though, since the movement is always backward with reference to the pupa, it is chiefly downward with reference to the outer world. A

sudden loud noise or a very gentle tap upon the vessel containing the pupæ causes those at the surface to dart downwards, but, as slight sounds produce no effect upon them, Dr. Hurst concludes that the tremor of the surface of the water and not the sound itself is recognised by them. The setæ on the first segment of the abdomen are probably the organs by which this movement is felt.

CHAPTER VI.

Life History, Methods of Observing, Collecting, &c.

Mosquitoes and gnats can easily be kept for considerable periods in captivity through all the stages of their life history, and owing to this it is easy to obtain adult insects from larvæ, or, on the other hand, to obtain the latter by confining impregnated females under a suitable environment. The usual food of probably all species of both sexes is the juices of plants, and although the females of many attack and suck the blood of vertebrates, food of this sort does not seem to be in any way essential to their welfare, as they will lay their eggs equally well on a purely vegetable diet. Moreover, even in the case of notoriously troublesome species, it is often difficult to induce them to bite animals, although they will still feed on their more usual vegetable food. A high atmospheric temperature appears to be the main determining condition of these outbursts of a sanguinary instinct, and this is probably the reason why, in spite of gnats being quite common, we are so rarely troubled by their attacks in England, for it is noticeable that whenever there occurs a spell of exceptionally hot weather, we find in the press notices of the occurrence of Mosquitoes, which, however, always turn out to be common indigenous species when submitted to a competent entomologist. Both males and females, but especially the latter, are much longer lived than is usually believed to be the case, and it is by the survival of hybernating impregnating females in sheltered nooks that the continuity of the species is ensured, for, as far as we know, none of the larvæ are capable of enduring even a temperate winter. It is, however, possible, though not proved, that egg masses laid

at the end of the season may retain their vitality till the return of weather warm enough to admit of their being hatched out. With but one known exception, that of C. salinus, noted by Ficalbi, it is only the females that bite and with them it is but an occasional habit. Minute as is the sting, it produces considerable swelling of the skin, owing to the injection of an irritating fluid, which is supposed to assist the flow of the blood through the proboscis by rendering it more fluid. Only the females sting, and it is noticeable that different persons differ greatly in their reaction to the stings of these insects. When Mosquitoes are unable to obtain blood they suck the juices of plants. They are frequently found on flowers and especially on the catkins of the willow. On hot days and in places exposed to sunshine they remain at rest until the evening, but especially in wooded localities they often are active in the middle of the day, and may often be observed perched on leaves and making a sort of balancing movement of the body, by alternately bending and extending their legs in the same way as do many of the Tipulidæ.

When in the humour to attack, it is not only man, but also other mammals as well as birds that are laid under contribution; and it is probable that they do not even confine their attentions to warm-blooded animals, for if, as is most likely the case, they are the habitual intermediate hosts for the majority of the class of protozoal blood-parasites, of which that of human malaria is the best known example, it is clear that tortoises and frogs are the chosen victims of certain species, as hæmatozoa closely allied to Laverans parasite are well known to occur in animals of these classes.

The different genera, and even the various species within the genera, differ greatly in their habits of life. The majority are crepuscular, loving the twilight, but many species are nocturnal, and not a few are active in the daytime. They differ equally in the localities favoured by them. The majority of the genus Culex may almost be said to be commensals with, even when they do not feed upon man, and are hence found almost exclusively in the

neighbourhood of dwellings; on the other hand, the genus Megarhina inhabits exclusively deep tropical forests. Linch Arribálzaga, in his "Dipterología Argentina" (Revista del Museo de la Plata, 1891), classifies the habits of the genera of the family as follows:—

(1) Domesticæ, Genera; *Culex, Tæniorhynchus.*

(2) Campestræ, Genera; *Ochlerotatus, Heteronycha, Janthinosoma.*

(3) Palustræ, Genera; *Anopheles, Aedes, Uranotænia.*

(4) Silvicolæ, Genera; *Sabethes, Psorophora, Megarhina.*

There is of course nothing absolute in such an attempt at a classification of habits. The genus *Anopheles*, for example, is quite commonly found in the adult state in houses, but even so it is in marshy places alone that the larvæ are found, although this need not imply the necessity of marshes of any extent, as mere puddles near houses will serve their purpose; but still, it appears that they never choose waterbuts and similar artificial collections of water such as are the favourite haunts of *Culex* larvæ. It is quite useless to look for the larvæ of the common domestic species in streams or pools in the open. During the spring I sought everywhere round Plymouth for *Culex* larvæ, only to find them in abundance in an old paint pot, left by some workmen in the corner of my garden, which had been filled with water by some heavy showers.

In running streams and other collections of water containing fish, it is quite obvious that *Culex* larvæ can stand but little chance of surviving, and with the exception of the larvæ of *Corethra*, whose exquisite transparency affords them considerable protection, it is rare to find any species in such waters. As fish exist in the majority of large marshes, it is obvious that the presence of large marshes can have less to say in the production of malaria than has hitherto been supposed. It is the small puddles that are necessarily common in localities, having the configuration necessary to the production of large marshes, and not the large marsh itself, that constitute the nurseries of the obnoxious species. As an exception to the statement that the presence of fish is fatal to the existence of *Culex* larvæ.

it should be noted that certain species appear to be in the habit of hiding under the leaves of water plants, and the commonly grass-green coloration of *Anopheles* larvæ appears to lend itself particularly to their secreting themselves in this way. In equatorial climates, where there are no long periods of either cold or very hot dry weather, Mosquitoes probably breed all the year round, but in most climates breeding is confined to the warm, rainy portions of the year. At other periods no Mosquitoes will be seen about on casual observation, but a careful examination of secluded corners will always result in the discovery of numbers of hybernating, impregnated females, which, though sluggish, generally retain sufficient alertness to fly off at the approach of the housekeeper's brush.

In temperate climates the power of hybernating is an obvious necessity for the continuance of the species, and, at any rate in northern India, there is no doubt that the local pests not only hybernate in the cold weather, but subsist in a very similar condition during the intense dry heat of the earlier part of the summer. In the North-west Provinces and Punjab, although the winter air temperature may not fall so low as in Europe, the radiation at night is so powerful as to occasionally freeze the small collections of water most favoured by Mosquitoes, and in any case to render them too cold for the survival of the larvæ. In the "hot weather," on the other hand, all small collections of water are so rapidly dried up that it is impossible for the females to find suitable places in which to deposit their eggs, and the power of resting in a quiescent condition is as necessary to the persistence of the species as it is during the winter of Lapland. This fact of hybernation obviously suggests a prophylactic measure in ridding a locality of these annoying and dangerous insects. The adult Mosquito probably rarely wanders far from the puddle in which it passed its larval youth. In other words the Mosquitoes that infest, for instance, an ordinary Indian bungalow, have probably been nurtured in some tank or puddle in the "compound," and where the latter is as large as it commonly is, it is probably rare for visitors to arrive from a

greater distance. On this account it is clear that a thorough cleansing of the premises, including of course the servants' huts as well as the main residence, by lime or colour washing throughout, done during the cold weather, would go far to diminish the number of surviving females. Previously to doing this, the rooms, especially the servants' quarters, might be thoroughly smoked with green wood and sulphur. I merely suggest this as a measure for the individual prophylaxis of Europeans resident in India and similar countries, as I am far too well acquainted with the indigenous population to entertain the least idea of their being induced to undertake so troublesome a procedure, which indeed would be in any case of little avail among the crowded dwellings of a native town, unless everyone went to the same pains.

Hangings, such as curtains and draperies of all sorts, are favourite refuges for Mosquitoes, and in conducting such a winter cleaning as that suggested, it would be well to take these down with as little disturbance as possible, and before cleansing them, to roll them tightly up while still in their natural folds, so as to crush any insects that may be concealed in them. Hangings of all sorts are indeed better dispensed with in tropical houses, for besides harbouring hybernating females during the cold season, they also form their favourite refuge during the heat of the day at the seasons when the insects are most active. Besides this they exclude light, and nearly all the troublesome species have an even stronger aversion to light than they have to heat.

Mosquitoes have a tendency to leave houses to seek vegetable food at dusk, and again retreat to it shortly after sunrise. On this account it is well to throw open all doors as soon as all lights have been extinguished, and to close them again at sunrise. In speaking here of doors, I do not of course refer to the solid main doors, but merely to the light frames filled with wire gauze, which should be fitted in addition, in all well-found tropical residences. In many climates, however, it is scarcely tolerable to keep even these closed, and where this is the case, it should be remembered

that it will probably suffice to keep the doors carefully closed for an hour or two after sunrise, as by that time all the Mosquitoes will have settled down for the day, and there is little danger of any number entering. In the way of protection against the bites of these insects, the only measure of any great use is the careful employment of Mosquito curtains. Like most other insects they seem, however, to have a strong objection to the scent of essential oils, phenyle and other forms of carbolic acid, and while the scent lasts they no doubt give a certain amount of protection. The drawback to the majority of these agents is that they evaporate so rapidly that any protection they may exercise lasts for but a short time. Paraffin is probably one of the best and most lasting "scents" to use for this purpose, but the smell is so objectionable to the majority of people that its adequate use would be little short of intolerable, and the same applies to oil of peppermint, which also enjoys a certain reputation for this purpose. As a matter of fact, the number of materials of this kind that have been vaunted by one or the other vendor of specifics is enormous. I was recently told by an English pharmacist, in business in the Riviera, where Mosquitoes are very troublesome to the unseasoned English visitors, that the essential oil of absinthium, made into a pomade with a little lanoline, and smeared on all exposed parts, was most effectual in keeping off these unwelcome visitors, and moreover, that the scent evaporated so slowly that the protection continued efficient throughout the night. The smell of this essential oil is by no means disagreeable to the majority of persons, and is not of a kind that cloys rapidly. Moreover, as the gentleman who was so courteous as to afford me this information desired to make no secret of the nature of the preventative he recommended, it appears certainly worthy of trial, at any rate during the evening when it is impossible to retire to the shelter of a mosquito curtain.

M. A. Veder states that the oil of American pennyroyal (*Hedeoma pulegioides*) is very efficient employed in the same way; and H. J. Johnston Lavis, on the other hand,

records the entire failure of a very careful experiment with extract of quassia, a reputed preventative with which I have myself experimented in India, and equally found quite useless. A strong infusion of the roots of the common couch grass (*Triticum repens*) is also said to be successfully employed in Siberia, where Mosquitoes are very troublesome at certain seasons.

Mosquitoes are fond of taking refuge under tables, and a very vulnerable point of attack is the ankles, where they are covered only by the stockings, the material of which affords absolutely no protection to the wearer; and it would be neither a troublesome nor a disagreeable measure to sprinkle or spray on these necessary articles of clothing some of the oil in question, sufficiently diluted with rectified spirit. It is clear, however, that during the adult stage, the only period at which the insects can be attacked with any effect is during hybernation, and I cannot but think, that as far as individual houses are concerned, some benefit might be gained by their systematic destruction during this period. The really vulnerable stage, however, of their life history is the larval stage; and here, on the one hand, by filling in and draining puddles, and on the other by the use of insecticides in such collections of water as cannot conveniently be treated in this way, I am convinced that much might be done. Fortunately, by far the most efficient of our known insecticide agents is so cheap, in the shape of paraffin oil, the commonest and cheapest sorts of which are by far the most efficient for the purpose, that the expense of very extensive operations need be no bar to its use. Another advantage of paraffin oil is that it is a well-known article of daily use among the races who inhabit the parts of the world most affected by malaria, so that no misunderstanding on their part is likely to arise from its employment, such for example, as arose in many places from the use of permanganate of potassium for disinfecting wells in India. At the same time, it would probably be well for the conservancy men employed to purchase the kerosine required for the purpose in small quantities in the local bazaars, so that the commonplace nature of the material employed

might become a matter of common knowledge. No one who has not been employed in the work can have any idea how easily the most extraordinary and groundless suspicions are aroused among the semi-civilised people, with whom we have to deal, by the simplest and most obvious of sanitary precautions; and in any time of "scare" I should never be surprised to hear that some of our Indian townsmen gravely suspected their governors of the intention of setting fire alike to the soil and waters of their habitations, with no better basis than the sprinkling of a few puddles with mineral oil. The use of kerosine for the purpose of destroying Mosquito larvæ appears to have been first adopted in America. Some thirty years ago, L. O. Howard ("Insect Life," vol. vi., p. 90) describes a "second" experiment with this plan. The Mosquitoes, in this case, were derived from a pond and marsh of an area of about 4,000 square feet. On June 4, he sprinkled over this fifteen gallons of the cheapest kerosine. This formed a continuous layer, and remained evident to the senses, in the absence of rain, for two weeks. Three weeks after, the place was revisited, and though a slight shower had fallen on the 17th day, the kerosine was still operative. No trace of living aquatic larvæ of any kind could be found, and the surface of the pond was strewn with dead insects, among them many female Mosquitoes. In the dwelling near, which had previously been infested with these pests, only a few living Mosquitoes were noticed during June, but none subsequently, and though the treatment was not repeated, none appeared in July. The entire cost was but $1·70, with four hours of light labour; and the author adds that he knew of two other successful cases. This experiment appears quite conclusive of the value of this method, when thoroughly carried out; and it further demonstrates another important point, namely, that the infestment of a dwelling often proceeds from a single source, and that once this is successfully dealt with, new immigrants from other sources are long in appearing. Major Ronald Ross, I.M.S., who was, I believe, originally somewhat sceptical as to the value of kerosene, has returned from his West African Expedition

fully convinced of its value, and appears to have found a very much smaller proportion of the agent effectual than that used in the American experiments, as the correspondent of the *B. M. J.* (Oct. 14, 1899) mentions that it was found sufficient to "paint over" the pools with a rag, saturated with the oil, fastened to the end of a stick. I must confess that I am somewhat sanguine as to the practicability of carrying out this method, at any rate in Cantonments and the smaller municipalities in India. In villages there is no sufficient agency to carry it out, and in large towns the supervising agency is quite inadequate to secure its thorough adoption. But I can see no reason why a great deal of good should not be effected in smaller places, especially where the Supervising Officer has been sufficiently long stationed in the place to get personally known to the inhabitants, and so can occasionally inspect the private court-yards without giving rise to annoyance and misapprehension. It would be, however, a great mistake to attempt anything of the kind by "regulation," and if attempted at all, it should be in an unofficial and friendly way, and where an officer is a stranger, it will be well for him to confine his attentions to the tanks and puddles outside private limits. The experience of the West African Malaria Expedition was, that the dangerous *Anopheles* larvæ inhabited almost entirely, not disused earthen vessels, cans, and other similar artificial collections of water, as in the case of *Culex* larvæ, but natural puddles, either completely still, or with some very slow trickle of water through them.

The illustration of an "Anopheles puddle" given (*l. c.*, p. 1,033) by the correspondent, is just such an one as can be discovered outside many an Indian hut, in the course of the channel made for itself by the water wasted in domestic purposes. For that part of the matter, it is just such a puddle as may be found outside one's bathroom, in a large percentage of European residences in India; indeed the European's puddle will probably be the more dangerous of the two, because being composed of cleaner water, it is more likely to be fit for the growth of the green algae

which being the principal food of the larvæ, are necessary to their well-being.

For this reason the work of dealing with *Anophelès* puddles in Indian towns may be less hopeless than might at first sight appear, for most of the receptacles used for the reception of domestic waste-water are far too foul for the growth of green algae. Sumarising the results of the observations of the expedition, the correspondent (*l. c.*, p. 870) writes "It is best to begin with a list of places in which *Anopheles* larvæ are *not* found—at least generally. These places are: (1) very evanescent rain-water puddles; (2) puddles free of green weed, fungus or algæ; (3) puddles in water-courses and other localities which are apt to be scoured out by heavy rain; (4) large pools which do, or may contain minnows; (5) rapid streams, drains, or runnels; (6) wells, cisterns, pots, tubs, &c." On the other hand, the larvæ are often—or indeed generally—found in (1) small, slow runnels flowing on soil and containing green algæ, flocculent waterweed; (2) small puddles containing algæ frequently replenished by the overflow during rain of the above; (3) stagnant and fairly permanent collections of water containing algæ or green fungus, and not capable of being scoured out during rain.

In searching for larvæ, it is little use attempting to do so by a mere inspection, as owing to their universally protective colouring, it is easy to overlook them, even when present in large numbers, if one merely stoop down and peer into the puddle. The examination should be made by dipping up some of the water from the surface of the puddle in an ordinary tumbler, and examining it by transmitted light. If care be taken not to disturb the mud at the bottom, it will usually be easy to do this at once, but if the water have been rendered turbid in its collection, the specimen must be put aside till it settles. As has been seen, large pools are unlikely nurseries for these larvæ, but this is owing probably to the general presence of fish in such situations, than to any inherent unsuitability, and on this account it will be a good plan to introduce fish into any permanent pools that may exist in a locality.

Several species of pond fishes in India are capable of surviving the apparently complete desiccation of the pool in which they live, by burying themselves in the mud till the recurrence of the rains, so that the task of introducing them into any ponds where they do not exist would seldom require repetition, and the expense and trouble of doing so would be very small. We can now understand how it is that the introduction of a pure water supply into some of our larger Indian towns has not resulted in the improvement of general health that was hoped for. As the introduction of the pipe-supply has not been accompanied by any attempt at the improvement of surface drainage, the waste from the taps has resulted in numberless small "runnels," just such as form ideal nurseries for *Anopheles* larvæ, and the inevitable improvement in the ravages of filth diseases has been counterbalanced by an increase in malarial cases. This at least appears to be the probable explanation, in the light of the knowledge of the methods of the propagation of malaria which has so recently been gained; for no statistics that are available are compiled on data that can be of any value whatever in determining the issue. From these considerations it follows that surface drainage is the only measure of general sanitation that can be of any great service in the prevention of the disease, and that it is doubly necessary in places which enjoy the benefits of a modern water supply. Something, too, might be done by the adoption by Municipalities of by-laws prohibiting the indiscriminate honeycombing of the surface for earth for building and plastering purposes. Such a regulation need not give rise to any real inconvenience, as tanks and other excavations of a size unlikely to serve as nurseries for larvæ are so numerous in most such Municipal areas, that it would cause no hardship to insist on the earth required for such purposes being taken from their banks. The systematic filling up of small depressions with any hard rubbish that may be available is another measure that obviously suggests itself, and as the most dangerous collections are generally quite small and shallow, need not be beyond the pecuniary resources of even small places. As regards

individual prophylaxis, it is obvious that Europeans may do a great deal to protect themselves by doing away with all pots and other receptacles of stagnant water, so as to discourage the breeding of the annoying, if not dangerous *Culex* larvæ, and by dealing with all puddles likely to harbour *Anopheles* by filling in such as can be dealt with in this way, and treating the others to the periodical administration of kerosene.

Major Ross has noted a curious point in the habits of the perfect insects of *Culex* and *Anopheles*, which will be of great practical use to the lay observer in enabling him to distinguish between members of the two genera; and this is, that the insects, when sitting on a wall or similar surface take up entirely different attitudes. In the sitting *Culex*, the body is kept nearly parallel with the surface on which it is resting, while in *Anopheles* the proboscis points towards the wall, and the body is held at so sharp an angle to it as to be nearly vertical, so that it "looks rather like a thorn affixed to the surface by the point." In both genera, the insects, when at rest, support themselves on the four anterior legs, and keep the hinder ones elevated and stuck out behind them, but naturally they are much more elevated in *Anopheles* than in *Culex*.

Owing to the fact that their eggs are deposited in masses containing from 150 to 300 ova, these insects always appear in swarms. The impregnation of the females usually takes place within a short time of the imagines emerging from the pupa skin. For this reason it is rare to capture an unimpregnated female, and in order to secure a supply of larvæ, and subsequently of perfect insects, all that is required is to capture one or two females uninjured, and to place them in a situation where they can lay their eggs undisturbed. As the larvæ of all species are aquatic it is obvious that the imprisoned insect must have access to water.

The most convenient apparatus is a large bell-glass such as is used for keeping gold fish; this is filled with puddle-water, as ordinary clear water would not contain sufficient nourishment for the larvæ. In the case of *Anopheles* larvæ it would probably be well to employ a shallower vessel and

to place some mud at the bottom. On to the top of the bell-glass fit a cover of tin, with a large central opening—a mere ring of metal in fact, with a rim fitting the circumference of the bell-glass loosely but deep enough to prevent its being easily displaced. On the top of this are soldered two loops of brass wire crossing each other and about 12 or 15 inches high, which is designed to act as the support of a bag of mosquito-netting drawn over the wire loops and secured to the tin rim by a binding of string. Although the central opening should be as wide as possible the ring should be wide enough, at any rate, for some portion of its circumference to serve as a ledge on which to place fruit, or a capsule of syrup to serve as food, for which purpose a ripe banana partially peeled is best, though a slice of pear or a soft apple or plum will serve very well. Failing fresh fruit, a watch glass containing a mixture of syrup and sherry is said to answer well, and probably honey would form an excellent form of nourishment. A very handy little apparatus may be improvised from one of the ordinary prune bottles fitted with a screwed metal top. The greater part of the middle of the cap is cut out, taking care to leave at one point of the circumference a tongue-like projection to serve as a support for food. A single loop of wire is soldered on to the sides of the cap, of sufficient height to serve as a support for the bag of mosquito-netting, which when bound with string to the rim of the cap completes the apparatus. They are most useful for rearing perfect insects from a comparatively limited number of larvæ taken from some natural source, as they hardly contain water enough to afford nourishment for the large swarm of larvæ that are hatched out from one or two egg-boats laid by a captive mother.

Although most of the larvæ subsist largely on algæ, they are also carnivorous, so that the best source of water to supply them is that from some green slimy pool containing numbers of water-fleas and other small crustaceans. It is essential also to have a few scraps of dead leaf or chip floating on the surface of the water to serve as a raft, on which the gnat may sit when depositing her eggs. The

apparatus having been prepared, the captured insects are liberated within the dome of net which is replaced over the bell-glass, and some food placed on the ledge prepared for it.

Within a day or two some small bodies, not unlike caraway seeds in size, form and colour, may be noticed floating on the surface of the water. These masses are the egg-boats, and once they have been deposited the mothers may either be killed and pinned for the permanent collection, or may be left and provided with food, in order to observe their subsequent behaviour. Each egg-mass contains some 200 ova, each of which is a cylindrical body, more than twice as long as its diameter, with rounded ends. The lower or immersed end is furnished with a curious opening, or rather thinning of the egg-shell, and is surrounded with some curious radiated markings. The object of this arrangement is probably to enable the embryo to obtain oxygen from the water in which the little raft floats.

The insects pair towards evening. The males assemble in large numbers, flying hither and thither without travelling far, and the females appear among them in smaller numbers so that the moment one appears she is clasped by a male, allowing themselves to float in the air, or flying together. The coupling only lasts a few moments, and when it is completed the pair separate and the fertilized female proceeds to deposit her eggs. The eggs are laid in water, where alone the larvæ are capable of living.

The attitude of the females when depositing their eggs is peculiar. Alighting on some floating body, such as a leaf or scrap of wood, they gather together the four anterior legs as support, while the posterior legs are crossed behind them so as to form an acute angle, and it is into this angle that the eggs are dropped side by side, until an elongated, boat-shaped mass is formed, somewhat raised at each extremity. The hind legs which carry them are extended little by little until the boat is finished, when the insect allows it to drop into the water at the mercy of the wind.

Gnats give birth to several generations between early spring and the end of the autumn. Each boat consists of from 250 to 300 eggs, which latter are oblong, more pointed

at their upper extremity as they lie in the boat, larger and more rounded below, and ending abruptly in a bordered edge, much like that of certain liqueur flasks; the opening of this may be said to be closed by a thin membrane, by the rupture of which the larvæ escapes.

The egg boats must needs float on the surface of the water, as the embryos perish if they become submerged. Only their neck comes in contact with the water. When just hatched the eggs are entirely white, but they soon become shaded green, and in less than half a day they become grey. Usually the eggs are laid between five and six in the morning, and the larvæ escape in two or three days. The larvæ swarm in spring and summer in the stagnant water of tanks and other domestic collectors of water, where they may be found in abundance in Europe from the time the ice is melted. Usually they keep at the surface of the water or a little below it, in an inverted position, the head being lowest, breathing by means of the tube placed at the extremity of the abdomen. They are extremely lively and easily disturbed by any movement of the water, but soon resume their old position. Their body is elongated and has no legs. At first greenish, they soon become greyish and transparent. The larva undergoes several moults, three taking place in the first two or three weeks. In order to get rid of the old skin it places itself horizontally on the surface of the water with the back upwards. As a rule the change takes place through a rent on the thorax, and extends after to the abdominal segments. Like the larva the nymph is capable of swimming but can take no nourishment. When in repose it is contracted into a lenticular form, its abdomen being kept bent under the thorax and kept closely applied to it. It lies vertically in the water but in a different sense from the larva, as the humped-up thorax forms the highest part, and it is from the dorsal surface of that part of the body that the respiratory syphons spring, being in the form of two horns or asses' ears. Their upper extremity is cut obliquely, and when the pupa is at rest is always kept above the water. The eyes are distinct, and beneath the thorax is found a large mass

consisting of the antennæ, mouth parts and legs. The abdomen is elongated; segmented and terminated by two oval plates. If the nymph desires to go beneath the surface of the water it straightens itself and gives a few strokes of the tail, but is soon carried back to the surface, as soon as this has ceased to act, by its own buoyancy. After passing five or ten days in this state, the insect is ready for its last metamorphosis, but this is a most critical period of its life, as if the nymph case upsets during the process of the imago's freeing itself the insect perishes by drowning, as it is now entirely unable to survive the element in which, up to now, it has passed its life. The moult that frees the imago from the nymph integuments takes place in the same manner as the preceding ones; a rent appearing in the upper surface of the thorax through which the gnat protrudes first the head and thorax as much as possible above the aperture. The posterior extremity of the body now contracts a little, and, extending itself immediately after, is gradually drawn out in a perpendicular plane. Meanwhile, the old skin of the nymph serves as a sort of boat of which its own body serves as the mast, only a very small portion of the hinder extremity touching it. Next, having drawn from their sheaths the four anterior legs and then the hinder ones, it carries them forward. Soon after it bends towards the water and arranges its limbs, and thus assured of safety it unfolds its wings and flies off. When first it escapes it is whitish with the thorax greenish, but it very quickly after assumes the proper colours of the adult insect.

The duration of the different stages as given in the above general account must be understood to be in no sense absolute, as even in the same species it varies greatly, being much accelerated by warm weather and indefinitely retarded by cold. Broadly speaking, the life history is the same for all the Genera of the family, but as may be seen from the context, the description applies in particular to *Culex*. It remains to notice the peculiarities of the habits of the different Genera.

Culex larvæ prefer small collections of water of no great

depth, but in any case it must be rich in plant growth. With a few known exceptions, they are confined to fresh water, *C. salinus*, Ficalbi inhabiting brackish water, while Dr. T. L. Bancroft has met with four species of *Culex* and one of *Anopheles*, whose larvæ he found in sea water at Deception Bay, Queensland. The common house species will only be found in pots of water and similar places as well as in wells in India, but there are many others which are never found in houses, and the larvæ of these will be found in a variety of waters in the open, always provided that the current is small and that there are no fish. In temperate climates they may be found in the early spring as soon as the ice has disappeared, as early as March, for example, in Northern Europe, and they continue to be found till late autumn, as late as October in England. When first hatched, the larvæ remain in a vertical position beneath the water, but soon come to the surface and assume a slanting position, with the head downwards and the ends of the breathing tube at the surface of the water. When disturbed they escape by darting downwards and backwards and, if pursued, evade capture by vigorous lateral movements of the body, which result in a curious zig-zag motion. When at rest the whorl-organs are kept in constant motion, and keep up a current which sweeps any nutritive particles that may be near, within the grasp of the jaws, and their constant action keeps the creature in gentle motion, sometimes revolving on their axis or slowly sinking, but they never remain more than a few minutes beneath the surface. Previously to the change into the pupa stage they undergo four or five ecdyses, and the final change into the perfect insect occupies about forty-five minutes. The larvæ cannot survive cold, and in Europe certainly, any that have not completed their metamorphosis by the return of winter die.

The habits of *Anopheles* larvæ are very different. Major Ronald Ross states that in India he found that the female insects deposit their eggs not in water but on hard surfaces, such as the wall of a test tube, the eggs being laid separately in roughly star-shaped groups. This must, I think, be

accepted with some little reserve, as the confined space of a test tube does not sufficiently copy natural conditions to enable us to be sure that the insect acted in this way except under compulsion. I have seen the female of *Culex pipiens* act in the same way in a pill-box, the insect being, I suppose, so heavy with eggs that she was unable to avoid dropping a certain number, and I do not think that a Mosquito can take up her position on the water for the purpose of ovi position unless she lights on it from flight. An attempt t crawl on to the surface of the water from the side of a tes tube would probably result in the insect getting wetted, an she will avoid this at any cost, and there can be no doubt c the fact that in nature *C. pipiens* will never deposit he eggs elsewhere than in water. Meinert, in his carefu observations of two species of *Anopheles* makes no mentio of any habit so abnormal to the customs of the family, an from the context there is no doubt that he observed hi larvæ in captivity; while Arribálzaga, in his monograph c the Argentine *Culicidæ*, definitely states that all the *Gener* of the family deposit their eggs in masses on water. I must be remembered, too, that in the species we know bes the eggs of *Culicidæ* require to be developed not only i water, but must be kept during their maturation in a certai vertical position, half in and half out of the water, and tha stray eggs dropped into water at random, or the egg boat if immersed, do not survive.

Owing to the difference in the anatomy of their breath ing apparatus, the larvæ of *Anopheles* behave very differentl from those of *Culex*, the want of the long air tube necessi tating their maintaining themselves in a nearly horizonta position, close to the surface of the water.

In addition to being found in puddles, many species ar found in still or slightly rippled water, wherever there i plenty of aquatic vegetation, alike on heaths and in woode regions, but they prefer plenty of sunshine, and so ar seldom found in close woods. The larva lies straight ou in the water, with the stigmata of the eighth abdomina segment just out of the water, and the rest of the body except the front of the thorax, which is just awash

immersed. The long bristles of the thorax and abdomen are the main agents in keeping it steady in the water. They are very cautious and timid, but rather sluggish in their movements as compared with *Culex* larvæ, moving gently backwards under the influence of the vibrations of their whorl-organs. If disturbed they, however, dash downwards, but when they have reached the bottom they rise again by means of quick, broad bending movements of the body, with the tail stuck out. Another of their peculiarities is that they have a habit of twisting the head so that the lower surface looks nearly upwards, and will often remain working their whorl-organs in this position for a long time. The object of this peculiar attitude probably is to bring within reach of the vibrating organs the rich layer of microscopic organisms that accumulate on the surface of the water.

Corethra larvæ are much less restricted as to the character of the collections of water in which their larvæ are reared, being often found in deep still water containing but little vegetation as well as in very foul pools. Their position in the water is even more absolutely horizontal than that of *Anopheles*, whose position is slightly oblique, and they retain this horizontal posture even during their excursions below the surface. They are very voracious, devouring not only *Daphniæ* and other small crustaceans but also *Dixa* larvæ and even young fish and molluscous embryos; nor do they even shrink from cannibalism, smaller specimens of their own species being devoured with gusto if they come within the reach of their jaws. It is only the very young larvæ that are so absolutely transparent, as when older they develop a number of patches of pigment, and the contents of the intestinal canal obscure the complete transparency of the body. Still, it is doubtless owing to this transparency that they are the only gnats whose larvæ can live among fishes. All their ecdyses are performed with singular rapidity, even the final emergence of the imago taking only a few minutes to accomplish. Their pupæ assume a nearly vertical position in the water, but otherwise do not differ greatly from those of other genera.

The eggs are laid in small, round, jelly-like masses, containing about 120 ova, but it appears rather difficult to secure the complete observation of the cycle of life in captivity, doubtless because it is harder to secure for them any good resemblance of their normal surroundings. As already remarked, we are practically quite without information as to the habits of the larvæ of *Ædes* beyond the fact that they present a general resemblance to those of *Culex*.

Meinert states that the larvæ of *Mochlonyx* affect the waters of fields and woods, and that they are especially often found in such places as ditches, where the water is clear, but without any particular current. The larvæ do not survive the winter, but he considers it probable that the eggs do, as he has found newly-hatched larvæ so early in the year as to make it highly improbable that any of the perfect insects could have emerged from their hybernation, even assuming that the adults do hybernate. In a warm room, in captivity, all the changes from egg to imago were gone through in three weeks. Unlike *Culex* there appears to be only a single generation of larvæ developed in the year. The position taken up by the larvæ is very like that of *Corethra*, but they are more in the habit of remaining under water. They are voraciously carniverous, and appear to be even more arrant cannibals than the larvæ of that genus. The pupa also behaves much like that of *Corethra*, but it is not quite so rapid in its changes of skin.

Under a convenient simple microscope the dissection of well-grown larvæ is not a difficult matter, but it is little required except for the observation of histological details, as most points of their anatomy are best observed in intact young living larvæ. If their movements are embarrassing, a drop or two of cocaine solution will quiet them, though not so rapidly as might be expected, as they are singularly refractory to poisons introduced into the water in which they are. In preserving larvæ for histological purposes by killing them with 1 per 1,000 solution of perchloride of mercury I have often found many still active after an hour. For this reason I am inclined to suspect that the thin layer

of kerosene on the surface of the water, in the above-mentioned experiments, kills rather by clogging the breathing apertures than as an actual poison, and I doubt the probability of soluble insecticides proving of much use in any but prohibitive quantities. All solutions, in fact, penetrate their chitinous covering with great difficulty. Entire larvæ are best mounted as microscopic objects in 4 per cent. formol solution, to which a very little glycerine has been added, but I should doubt if such mounts would be very permanent, especially in hot climates, so that it will be well to preserve a few slides with Farrant's solution. The slide should be first prepared by forming on it a shallow cell of Hollis's liquid glue, of such size that the edge of the cover rests on the middle of the cell-wall, leaving an edge of the glue outside it. This should be allowed to set but not to dry hard before using, so that the edge of the cover can be imbedded in the semi-solid material. When all superfluous preservative has been drawn off with blotting-paper, a ring of the glue is run round the edges of the cover and the preparation set aside to dry. The sectionising of perfect insects is even more difficult than that of the larvæ, as unless the razor be exceptionally keen it carries the dense chitinous covering before it instead of cutting, and so crushes the internal parts.

There are, however, many structures alike in the larva and adult insect which can be demonstrated in no other way than by the method of serial sections, and as already mentioned, there are especial difficulties in applying this plan to animals with a chitinous integument. Thin as it is in most of the species with which we have to deal, it yet is apt to resist anything but the sharpest of razors, and, what is even worse, is well nigh impervious to the entry of preservative and other fluids, so that I have found it quite impracticable to adopt the plan of staining *en masse* either in the larva or adult insect, so that all staining must be done after the sections have been fixed on the slide. After some experimentation I find that the following method may be relied upon to yield satisfactory and well-preserved preparations. For many of its details I am

indebted to suggestions from Mr. Allen, the Director of the Marine Biological Laboratory, at Plymouth, who has recently been working on certain copepods which are not altogether dissimilar organisms, as far as consistence is concerned.

The larva or adult insect, as the case may be, is killed by immersion in a solution consisting of two parts of alcohol (90 per cent.) to one part of aqueous solution of perchloride of mercury (1 per mille), in a test tube, which is then gently boiled for a minute or two so as to expel the air contained within the tracheæ. As the fluid cools it is necessarily drawn through the stigmata into the body of the insect, and is thus at once carried to all its tissues. It is left in this fluid for a few hours, and is then placed first in 90 per cent., and finally in absolute alcohol. To imbed it, it is first placed for at least twenty-four hours in oil of turpentine and is then imbedded in the usual manner in paraffin. As the various structures are very loosely connected it is very important to choose a specimen of paraffin with a melting point suitable to the temperature of the air of the place in which one happens to be working, for the least curling of the sections is fatal to the production of really satisfactory sections, so that it is well to try a sample of the paraffin in the microtome before employing it for embedding. In Europe, a paraffin with a melting point of about 105° is not at all too soft for the ordinary temperature of the laboratory, but in the tropics I have found samples melting from 115° to 125° most generally useful; the former for the cold, and the latter for the hot weather. The specimens should be kept for at least six hours in the bath of melted paraffin and are then, with due attention to orientation, placed in the microtome, which, it is needless to say, should be one of a type constructed to produce ribbands of serial sections, the ordinary pathological instrument being quite useless for this purpose.

As the sections are to be stained on the slide, albumen, and not creasote-shellac must be used for fixation.

A single drop of Mayer's albumen mixture (equal parts white of egg and glycerin, with 1 per cent. salicylate of

soda; well beaten up with an egg whisk and filtered) is added to a watch-glass of water and the slide is prepared by brushing over it a liberal allowance of this very dilute albumen, so that the sections rest on a thin layer of fluid. When as many of the series as the slide will accommodate have been arranged in position the slide is placed on the warm plate of the imbedding apparatus and warmed just sufficiently to flatten the paraffin and no more. It is then placed aside to dry as far as the presence of the glycerin in the mixture will allow; they are then replaced on the warm plate and the paraffin melted for a moment; after which they are successively passed through baths of turpentine, absolute alcohol, and 40 per cent. spirit, after which they are ready for staining.

For this purpose I find no stain better than Manson's methylen blue (borax 5 per cent., methylen blue 2 per cent. aqueous solution); this is allowed to act for several minutes and then washed off with water, after which it is well to give a ground staining of watery solution of eosine or fuchsine. After staining the slides are passed successively through baths of 90 per cent. spirit, absolute alcohol, and turpentine; and finally mounted in balsam. Gentian violet also gives good, and Ehrlich's hæmatoxylin fair staining, but I have not been able to get any result with borax-carmine. Working in England I have not been able to test this plan on infected Mosquitoes, but the perfect way in which the most delicate tissue elements are preserved, and the fact that it is so well suited to the use of Manson's stain makes it a hopeful method for demonstrating the parasites in the salivary glands. Great care must be taken to lose none of the series of sections, as the salivary glands are so small that they may easily be missed unless the series be fairly complete.

As the majority of workers at tropical medicine must necessarily conduct their investigations in places where there is no gas supply, such as is required for the working of the ordinary imbedding apparatus and other appliances involving the employment of self-regulating appliances for maintaining a constant temperature, it may not be out of

place to describe a simple piece of apparatus for the purpose which I have used for many years in India. It consists of a sheet of copper about 15 in. long, by 3 in. broad and at least $\frac{1}{12}$ in. thick. This is supported in a horizontal position on two wooden feet sufficiently high to admit of the chimney of a small paraffin lamp being placed under one end.

In addition to the ordinary copper capsules for containing the melted paraffin for imbedding, a special long narrow one is required. This is filled with a sample of the paraffin which is selected for use, and is then placed near the middle of the copper plate, not across, but parallel with the length of the plate. If the lamp be now lighted and placed under one of the projecting ends of the plate, its heat is conducted by the copper to the narrow tray, and it will be found that a greater or less proportion of its length will become melted. At the point where the melted and solid portions meet it is clear that the paraffin is just at its melting point, and opposite this point are placed the small capsules of paraffin in which the structures for embedding are to be placed. The long narrow tray, in fact, acts as a thermometer, and if the plate be allowed to reach, so to say, a settled condition before placing the capsules of tissues on it, it will be found that the heat of the lamp is quite uniform enough to render little or no close supervision necessary, and that in a still atmosphere it may often be left for hours without touching. I do not, of course, propose such an appliance as a substitute for the self-regulating one where gas is available, but where, as in most tropical countries, there is no gas supply, it will be found to be something more than an inefficient make-shift, and with a small amount of occasional attention will yield as good results as can be desired.

With the exception of the wings, which are best mounted dry, the cover being merely secured by a perforated label, parts of mosquitoes are best mounted in balsam, after passing through absolute alcohol and clove oil. Entire insects may be mounted dry in deep cells, or in Carpenter's cells, which are thin slips of wood, with a central perforation, which is closed on both sides by cover glasses. Before using

them the edges of the perforation should be brushed with creasote; but it is difficult to obtain a complete inspection of an insect so mounted, and the ordinary pinned specimens are better for all entomological purposes. It is better, however, than packing them loose, or worse with cotton-wool, in bottles or pill-boxes; but I cannot too strongly urge upon the collectors the importance of learning to pin and prepare the insects for entomological examination in the orthodox fashion, as it is well-nigh impossible to determine the species unless this is done. On this point I think I cannot do better than to reproduce *in extenso* the directions drawn up by Mr. E. E. Austen, the dipterologist of the British Museum, which run as follows :—

"LIST OF ARTICLES REQUIRED FOR COLLECTING AND PREPARING MOSQUITOES.

One entomologist's collecting-net of book-muslin (one or two spare net-bags should be taken in case the one in use gets torn).

One dozen glass-*bottomed* pill-boxes (1½ to 2 in. in diameter is about the best size).

A cyanide killing-jar, or materials for making same, as follows:—

¼ lb. of cyanide of potassium (in lumps).

1lb. of plaster of Paris.

A glass jar with wide mouth and closely fitting lid.

Entomological forceps (two pairs), with curved ends, for holding pins. (The 'ciliary' forceps of an eye case will serve).

One ounce No. 20 entomological pins (D. F. Tayler and Co., New Hall Works, Birmingham. These pins are sold in boxes at 7s. 6d. per ounce, and as the pins are exceedingly fine, an ounce will go a very long way).

Common pins (three or four packets).

Gun-wad punch, No. 20 bore.

Cards (4-sheet Bristol Board) from which to punch discs; a supply of the latter should be prepared ready for use.

Needles (two or three) mounted in handles, for arranging legs and wings.

A good pocket lens.

Cork-carpet or pith—one or two sheets about 6 in. square, on which to perform the operations of pinning, &c.

A strongly-made wooden box (a cigar-box will do), in the

bottom of which is fixed a layer of cork-carpet or pith (if the latter is used it should not be less than half-an-inch thick).

Importance of Sending Home Specimens for Determination in the Best Possible Condition.

It should be borne in mind that, for the purpose of the scientific determination of species, *mosquitoes cannot be collected with too great care.* As important specific characters are furnished by the *wings and legs*, it is of the utmost consequence that these should not be denuded of their scales, or otherwise injured; *unless attention is paid to this point the specimens will probably be quite worthless for determination.*

Spirit Not to be Used.

Specimens for determination must *on no account* be placed in spirit.

Specimens to be Pinned Immediately they are Dead.

Mosquitoes should in all cases be pinned, and that as soon as possible after death; duplicate specimens for dissection can, of course, be preserved in spirit, but if this is done care must be taken, by the use of corresponding labels or numbers, to prevent confusion between species.

Number of Specimens of Each Species Required.

In collecting specimens of a species of Mosquito for determination some *half dozen* examples of *each sex* should, if possible, always be obtained.

How to Distinguish the Sexes.

The usually harmless male mosquitoes can be distinguished from the females (which, in the majority of species, alone bite and suck blood) by the possession of plumose antennæ, forming tufts in front of the head; in the females the antennæ, though long, are nearly bare (having whorls of only short hair at the bases of the joints), while the palpi in the case of females of the typical genus *Culex*, to which the majority of the described species belong, are quite short. In the genus *Anopheles* the palpi are as long as the proboscis in both sexes, but are more swollen at the tips in the males.

Method of Collecting and Killing.

For capturing Mosquitoes in the open an entomologist's collecting-net is necessary, from which the insects can be transferred to glass-bottomed pill-boxes; in doing this great care

must be taken not to pull off the legs; inside buildings it is possible, with care, to capture Mosquitoes on walls and windows in the pill-boxes themselves. Specimens of species that habitually infest houses are best obtained in good condition by *breeding* them; this can readily be done by keeping the larvæ or pupæ in a basin of water covered over with book-muslin. In any case Mosquitoes should be collected alive in the glass-bottomed pill-boxes[1]; if care is taken, several specimens can be got into one pill-box. To kill the mosquitoes the box is opened a fraction of an inch on one side, and placed for a few minutes in a cyanide killing-jar,[2] which must, of course, be closed. As soon as the insects are quite dead (if the mixture in the jar is of reasonable strength from three to five minutes is sufficient, and mosquitoes should not be allowed to remain exposed to the effects of the cyanide longer than this), they should be turned out on to a sheet of cork-carpet or pith; they should be touched as little as possible, the manipulations necessary in arranging the wings and legs being performed with a needle.

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[1] These boxes can be obtained from any dealer in natural history apparatus, but care should be taken to see that the *bottoms*—and not the tops, as is often the case—are made of glass. Since the boxes are constructed of cardboard, they are liable in tropical countries to go to pieces in the rains, and to prevent this they should be covered with jaconet (cut *on the cross* and stuck on with liquid glue) and then coated with Aspinall's enamel.

[2] A cyanide killing-bottle can be procured ready for use from Hinton and Co., Bedford Street, London, W.C., or any other chemist will prepare one to order, but when Mosquitoes (or indeed *any* Diptera) are collected in the manner here advised it is preferable to make a large-sized killing-jar for oneself as follows:—Take any fairly large glass jar (such as a pickle-bottle) with a wide mouth and closely fitting lid, and cover the bottom with a layer of dry plaster of Paris to the depth of half an inch; pour in above this a layer equal in depth consisting of *powdered* cyanide of potassium, mixed with rather more than its bulk of dry plaster of Paris; cover this mixture with a layer of dry plaster of Paris to the depth of a quarter of an inch or so, and pour in above the whole a layer, half an inch in depth, consisting of plaster of Paris mixed with water to the consistency of cream. As soon as the top layer of plaster is dry the jar is ready for use. To obviate the risk of cracking the jar owing to the heat evolved when plaster of Paris is mixed with water, it may be advisable to stand the jar in warm water before adding the final layer. The exact amount of cyanide of potassium to be used is of no great consequence, but in the case of a properly prepared jar the odour should be readily perceptible on removing the lid; if it is not, the reason may be that the mixture is too dry, when a little water poured on to the top layer will probably set matters right. After some months' use the cyanide loses its efficacy (to obviate this so far as possible the jar should never be allowed to remain open), and the mixture must then be renewed.

To Pin a Mosquito.

Take a card disc and write on it all the data connected with the specimen to be pinned, as follows:—(1) Name of *locality*, including *altitude* if necessary; (2) *date*—day, month, year—thus, 9. 11. 98; (3) *collector's name;* (4) any *remarks of interest, e.g.*, "Most troublesome species in district"; "Abundant in bamboo-jungle"; "Uncommon," &c. Place the disc on a sheet of cork-carpet or pith, and picking up with the entomological forceps one of the fine No. 20 pins, thrust about one-third of an inch through the centre of the disc; in doing this the pin should be held by the forceps below the middle, otherwise, owing to its fineness, it may bend and fail to pass through the card. Lay the specimen *on its back* (turning it over with the aid of a needle or one of the No. 20 pins held in the forceps), and thrust the pin, which now carries the disc, through the centre of the thorax, between the bases of the legs, until the tip of the pin projects one-sixth of an inch beyond the dorsal surface of the thorax;[1] invert the disc (the specimen will then be right side up), and thrust an ordinary pin through the disc near the margin for the purpose of carrying both disc and specimen. The next and last thing to be done is to arrange the legs and wings as far as possible; *i.e.*, the wings must be made to project at an angle from the body, and not allowed to remain closed, and the legs must be disposed symmetrically on the card disc so that all parts of them can be readily seen, instead of being left crumpled up beneath the body. These operations must be performed as gently as possible with the help of a needle mounted in a handle, or by the aid of a No. 20 pin held in the forceps, and care must be taken that hairs and scales are not rubbed off in the process. As the tissues contract in drying, the legs and wings are very apt to get pulled out of place, and, to correct these changes, the specimens should be examined once or twice during the next day or two after being pinned.

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[1] Should it be found impracticable to proceed in the manner here prescribed, owing to the difficulty of making the specimen lie in the required position on its back, it may be pinned in the ordinary way through the middle of the thorax from the *dorsal* side; in this case, however, the specimen must be *pinned first* (*i.e.*, before it is mounted on the card disc); it should be drawn two-thirds of the way up the pin, and the latter should then be thrust through the disc, holding the pin with the forceps *below* the specimen; mount the disc on a common pin, as in the first method.

Preservation of Larvæ and Pupæ.

Specimens of larvæ and pupæ should always be preserved, especially when it is possible to breed some of them out, or otherwise to determine the species to which they belong. They should be killed and kept in alcohol or formol. If the former is used, ordinary methylated spirit will do, provided that the specimens are killed and preserved for three or four days in spirit diluted with half its bulk of water; after this they may be transferred to spirit of ordinary strength.

Of formol a 4 per cent. solution (*i.e.*, one part of ordinary commercial 40 per cent. solution to nine parts of water) is quite strong enough for killing and preserving.

Larvæ and pupæ (whether preserved in formol or alcohol) should be kept in small glass tubes, plugged with cotton wool to prevent the specimens from shaking about, and then corked; the corks may be coated with paraffin wax, though this is not absolutely necessary. Each tube should contain a scrap of paper on which the necessary data (locality, date, whether from fresh or salt water, collector's name, &c.—with, if possible, a reference to pinned specimens of the perfect insect, so that these may be identified) should be written in pencil.

The tubes should be packed in cotton-wool in a small tin box for transmission to England.

It is scarcely necessary to add that each species should be kept distinct, in a separate tube.

Observations on Habits, Distribution, &c.

Detailed observations on the habits, distribution, seasonal occurrence, &c., of Mosquitoes will always be useful, provided that care is taken to note the species to which they apply—the species being distinguished by means of letters or numbers attached to the pins of the specimens.

While it is certain that in a natural state only an infinitesimally small proportion of all the Mosquitoes that come into existence can possibly taste the blood of a warm-blooded animal, it is reasonable to suppose that primitively all *Culicidæ* fed upon the juices of plants. Indeed, it has been stated[1] that at the present day some species are still exclusively vegetarian in both sexes; that in others, while the males are vegetarian, the females suck animal blood—in some species only exceptionally, in others

[1] *Vide* Ficalbi *op. cit.*, p. 293.

habitually; and, finally, that there are species in which *both* sexes suck animal blood (this is said to be the case in an Egyptian species and in two Italian ones; it has also been observed in two species found in Madagascar, and has been noticed at Bannu, N. India.)

Investigators in countries infested by Mosquitoes will therefore, render especially valuable assistance by endeavouring, by means of their own observations, to supply answers to the following questions:—

(1) Are there any species of Mosquitoes that subsist wholly or in part on the juices of plants (or fruits)? If so, which are the species of Mosquitoes in question, and on what plants do they feed?

(2) In the species (if any) in which this mode of feeding occurs, is it confined to the *male* alone, or characteristic of both sexes? And is it habitual or exceptional?

(3) Are there any species of Mosquitoes in which the male sucks blood like the female? If so, which?

Transmission of Specimens to England.

Pinned specimens of Mosquitoes, like those of other insects, rapidly develop mould during the rainy season in tropical countries, and since mouldy specimens are practically worthless for purposes of scientific determination, the insect should be sent home as soon as possible after being collected. To contain the specimens, if a proper entomological store-box is not available, any small strongly-made box (such as a cigar-box) will serve, in the bottom of which a layer of cork-carpet or pith (not less than half-an-inch thick, in the case of the latter) is firmly fixed. The greatest care must be taken to prevent specimens getting loose and rolling about in transit, since in this way a single loose disc might easily destroy or hopelessly damage all the other specimens in the box. To prevent this the pins supporting the cards should be inserted as tightly as possible into the cork-carpet or pith, and they should all be driven in to the same level; if this is done a sheet of soft paper (newspaper does very well) can be *fixed* into the box, resting on the heads of the supporting pins, in order to mimimise the damage should a disc happen to get loose. The box containing the specimens should be well wrapped in cotton-wool, or similar material, and firmly packed in an outer box for transmission (by Parcel Post) to England."

Some naturalists, especially amateurs, mount smal insects such as Mosquitoes on tiny saddles of pith or cork, by means of some sort of liquid cement, a minute droplet of the cement being placed on the top of the saddle and the ventral aspect of the thorax pressed down on to it. It has the advantage of not disfiguring the thorax by transfixion with a pin, relatively as large as a scaffolding pole to the chest of a human being, but it renders the ventral surface quite inaccessible, and is but little easier to accomplish, as the real difficulty lies, not in the pinning of the specimen, but in the subsequent arrangement of the parts.

The regular pinning of a specimen is, however, by no means as difficult as it sounds; but it nevertheless seems to be difficult to induce the medical observer of Mosquitoes to adopt it, for I am sorry to say that as yet none of my friends have been induced to send me specimens so mounted, and I have accordingly been trying to devise some plan whereby a recognisable specimen may be mounted with the materials possessed by the medical histologist, and find the following plan, though uncertain, yields beautifully undamaged specimens:—The insect is introduced into a small pill-box—often it may be caught in it. Next take a sheet of stiff transparent celluloid, obtained by cleaning a waste film negative, and smear one corner with some sticky material, such as pure Canada balsam or shellac fixative for serial sections. Now cautiously remove the cover of the box and replace it by the varnished corner of the celluloid. Sooner or later the insect lights on the sticky surface and gets fixed to it by its feet, generally with its legs most naturally posed. All that now requires to be done is to open out the wings with the point of a dissecting needle and to press them down so that they get stuck, just by their tips, to the celluloid. As a rule the vapours of the creasote suffice to kill the insect, but if living it can be placed for a minute in the cyanide bottle, and it should be then left to dry, after which the piece to which the insect is secured may be cut out with scissors, and set in its place in the collecting-box by means of an ordinary pin in the same manner as a card disc. Although the insect cannot be

removed from it, most of the details of the ventral surface can be made out through the transparent celluloid.

The authorities of the British (Natural History) Museum, Cromwell Road, London, S.W., are I know always glad to receive specimens of *Culicidæ*, or indeed any other insects, and I may add that I shall personally be always grateful to any one who will send me Mosquitoes from any part of the world.

The subject of the methods of determining the relation of Mosquitoes to blood-parasites is rather outside the scope of a book like the present, but a few words on the subject may not be out of place. To infect a Mosquito all that is necessary is to introduce a few of the species under investigation under a Mosquito netting, beneath which the patient harbouring the hæmatozoa is to sleep. The insects should be females, and to avoid the possible fallacy of their having been previously infected, it is better, if possible, to employ for the purpose, only insects that have been reared in captivity from larvæ. Although a certain number of confirmatory experiments of the infection of the vertebrate host by infected insects are desirable, there is no need of such an experiment to establish the biological relation between Mosquito and parasite, for if it is found that the parasites ingested by the Mosquito with the blood of the infected vertebrate undergo developmental changes, it may be taken as proved that the species used is capable of acting as intermediate host, and is therefore dangerous to the vertebrate from which the infected blood was derived. It is well to make use of a fair number of insects in each experiment as all may not bite, and in any case some ten or a dozen will be required for dissection day by day in order to follow out the changes undergone by the parasites within the Mosquito. The method of dissecting out the stomach of the Mosquito has already been described, and it only remains to add that the best medium in which to examine is ordinary "normal saline" solution. If the stomach be very full of blood it is well to puncture it and shake it to and fro in a watch-glass of saline solution with the point of a needle, or which is safer, to irrigate it with drops of solution as it lies on the

slide. A tolerably high power is required, but a dry apochromatic one-eighth in. lens is adequate for the purpose, and is, I find, less troublesome to use than the old fashioned oil immersion one-twelfth. For permanent preparations Major Ross found nothing so suitable as formol solution, as balsam or glycerin render everything so transparent that all details are lost. Such experiments are, when negative, conclusive only when conducted at the season of the year at which the parasitic disease under investigation is rife, as at any other season it may possibly be merely owing only to unsuitable climatic conditions that the parasites fail to continue their cycle within the Mosquito.

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CHAPTER VII.

On the Distribution and Classification of the Family.

Classification.—By most authorities the family of the *Culicidæ* is divided into six genera, arranged in two sub-families, the *Culicina* and the *Corethrina*. Of the two sub-families the *Culicina* or true Gnats or Mosquitoes is usually divided into four genera, viz., *Megarhina*, *Anopheles*, *Culex* and *Ædes*. To these R. Desvoidy added the genera *Psorophora* and *Sabethes* portions of the genus *Culex* of other authors. Both these groups appear to me very natural ones, and well worthy of generic rank, and I have thought it accordingly better to retain both genera, although it is clear that the definition of *Sabethes* will have to be recast, a task which, however, must be left for the future, as the materials for doing so are at present insufficient.

Lynch Arribálzaga, in his monograph on the Argentine *Culicidæ*, has further separated from *Culex*, the genera *Ochlerotatus*, *Tæniorhynchus*, *Janthinosoma* and *Heteronycha*, as well as *Uranotænia* from *Ædes*; while Williston has even more recently added the genus *Hæmagogus* to receive a species which appears to come well within the original definition of the genus *Ædes*. With the exception of *Tæniorhynchus* none of these genera appear to embrace a sufficient number of species to afford any substantial relief to the undoubtedly unwieldy genus *Culex*; and in most cases their definitions appear to me to include the combination of so large a number of characters, that they are hardly likely to ever include more than a very small number of species. The inclusion of a too great number of characters in generic definitions is, to my mind, a practice much to be deprecated, for it defeats the objects of classification, as it narrows down the genus to a position of little more than specific importance. And

this is especially the case where the definitions are made to include characters rarely noticed at all by the naturalists that have gone before us, so that it is impossible to arrange within the new sub-divisions the species the latter have described without reference to the actual types, which, as a matter of fact, are often missing.

The *Culicina* are characterised by the possession of the typical long proboscis provided at its extremity with the small terminal lobes that represent the labial palps.

In the *Corethrina*, especially in *Corethra*, the proboscis is comparatively short, approaching rather to that of the *Tipulidæ*, and is provided with terminal, round, hairy knobs in *Corethra*.

The genera belonging to the *Culicina* are arranged according to the characters of their palpi as follows :—

Table of the Genera of the Sub-Family CULICINA.

A With the palpi about the length of the proboscis in both sexes.

a. With the terminal joints of the male subulate.

I. *Megarhina*, R. Desvoidy. Large species, with brilliant metallic coloration and a large proboscis strongly curved downwards. Usually of sylvan habitat.

b. With the terminal joints of the male palpi spatulate.

II. *Anopheles*, Meigen. Species of small or medium size and generally sober coloration, with the wings in most species dappled. Often found in houses, but not truly domestic.

B With the palpi about the length of the proboscis in the male, but quite short in the female.

c. With the shoulders provided with distinct pre-stigmatic processes.

III. *Psorophora*, R. Desvoidy. Soberly tinted species, generally having the male palpi near twice the length of the proboscis. Inhabit the open.

d. Without pre-stigmatic shoulder processes.

IV. *Sabethes*, R. Desvoidy. Species of dark, metallic coloration, recalling *Megarhina*, with some or all the legs peculiarly hirsute.

V. *Culex*, L. Species of varying size and commonly sober coloration. Wings not, as a rule, dappled. Mostly domestic, but found also in all sorts of situations.

C. With the palpi short in both sexes.

VI. *Ædes*, Meigen. Mostly rather small species, generally soberly coloured, but occasionally showing brilliant tinting. Generally inhabit sylvan localities, but many species affect the open.

The genera belonging to the *Corethrina* are arranged according to the comparative length of their first and second tarsal joints as follows:—

Table of the Genera of the Sub-Family Corethrina.

D. With the first tarsal joint longer than the second.
VII. *Corethra*, Ratke. Generally pale-tinted species of moderate size. Inhabiting the open or sylvan localities.

E. With the first tarsal joint shorter than the second.
VIII. *Mochlonyx*, Loew. One or two small species of sober coloration, inhabiting the open.

Distribution.—The *Culicidæ* are a truly cosmopolitan family, and may be found everywhere from the tropics to well within the polar circle. Their commonness indeed depends rather on the state of civilisation of a region than upon its geographical position. In new countries, in regions where the severity of the climate is such that they cannot support a sufficient population to undertake the complete drainage of the area, and amongst people whose civilisation, however old, has not reached the stage of "tidyness" and order, gnats and mosquitoes will be found to be numerous and troublesome. As examples of this may be mentioned the cases of Lapland and the north-western portions of British America, where, during the short summer, they constitute a veritable pest; so that, in the former country, the nomadic inhabitants are obliged to frequently change their grazing grounds to enable themselves and their herds to escape from their insect tormentors; while, in Manitoba, it is not uncommon for horses and cattle to be "stampeded" from the unbearable pertinacity of the indigenous species. In tropical countries again, the commonness of Mosquitoes is due far more to the difficulties of securing efficient surface drainage, and to the careless domestic habits of the people, than to any special favourableness of the climate. On the other hand, in countries such as England, Northern France and Germany, where centuries of human inhabitation have perfected drainage, and domestic neatness has reached almost to the position of a religious duty, gnats are so rare that, when

they appear in any numbers, they are commonly suspected of being a recent importation.

Even in Holland, where the nature of the country appears to be entirely in their favour, they are by no means so common as in many apparently less favourable localities; for in Holland drainage is a primary necessity of occupation, and the domestic neatness of the people is proverbial.

With the exception of a few rarely visited islands, there are few parts of the world whence the *Culicidæ* have not been recorded, and indeed their constant association with man makes it almost impossible for any country that is much frequented to long escape their importation, as apart from their being carried in the larval state in ships' tanks, their habit of hybernation, and of harbouring in draperies while in that condition, makes their introduction a very easy matter.

Mr. R. M'Lachlan, in his notes on the insects of Captain Fielden's Arctic Expedition, mentions a species of *Culex*, which, he says, may be *C. caspius* Pallas, as identified by Curtis in the insects of Ross's Voyage (p. 66). Schiödle identifies the same species with *C. nigripes* Zett. The latter, according to Staegel, occurs also in Greenland, and is the same as *C. pipiens O. Fabricius, nec Linné* ("Fauna Groenland," p. 201).

The late Professor H. N. Moseley, during the "Challenger" Expedition, described a species of "wingless *Culex*" from Kerguelen's Island ("Proc. Linn. Soc.," XII., p. 578), but it is almost needless to say that the identification was a wrong one, as none of the existing species are without wings.

In the beginning of the century, the "Nouveau Dictionnaire d'Histoire Naturelle," Tome VIII., Paris, 1817, states that only some fifteen species, mostly European, of the family were known, but since then the number has steadily increased.

Schiner, "Reise der Novara," notes that 132 species of the family had been described (up to 1868). Of these 30 are European, 61 American, 21 Asiatic, 10 African, and 9 Australian, with one of unknown origin. It appears that

the American and Asiatic genus *Megarhina* is unknown in Europe. *Corethra Manillensis* is the only Asiatic species of the genus, and as far as can be made out, *Mochlonyx* and *Ædes* are not represented out of Europe.

In 1889, Fred. A. A. Skuse, in the "Proc. Linn. Soc.," N.S.W., p. 1717, makes the following note :—

"These insects have a cosmopolitan range ; only *Mochlonyx* with 2 or 3 species appears at present confined to Europe, but it has possibly been overlooked in other countries. The brilliant species of *Megarhina*, although few in number, are widely scattered, being represented in North and South America, the West Indies, North and South Asia, the Eastern Isles, and in Australia. The typical genus *Culex*, comprising the true Mosquitoes, has a world-wide distribution and includes some 160 described species ; in Europe from extreme north to south about 30 species are known, and the same number are recorded from North and South America, of which 1 species, *C. annulatus*, is common to the former two continents; 2 species stand recorded from Mexico, and an equal number from the West Indies. In Southern Asia and the Eastern Isles about 25 species are known to occur, 11 have been named from Africa, 4 have been discovered in New Zealand, and in the present contribution (S. A. C.) no less than 21 are recorded from Australia. One species appears to have been introduced into this country (Australia) judging from the accounts of old Colonists, and is possibly a variety of *C: ciliaris, L.* It may have been imported from Europe in the water tanks of some of the old sailing ships. As the railway extends so this Mosquito reaches portions of the country hitherto exempt from it, and it has been, and is being communicated to other places along the coast, by water traffic. Certain descriptions in Meigen's and Macquart's works fit this species fairly well, as far as they go, but are much too brief and unsatisfactory to be of much value for conclusive identification ; and none of the more modern works giving descriptions of the *Culicidæ* being available to me, I have been compelled to give the description of this species without any name, in the hope that some foreign Diptero-

logist may be able to identify it. It is, *par excellence*, the nocturnal domestic pest of all the Australian colonies, rivalling its other wingless co-operators in bloodthirstiness.

"The genus *Anopheles*, although numbering but few species—less than 30—is also widely diffused. Five species are prevalent in Europe, 7 in North America, of which latter no less than 3 are common to it and Europe. One in the West Indies, at least 4 in South America, 2 in Southern Asia and the Eastern Isles, and lastly 5 is the small and undoubtedly unrepresentative total of Australian species.

"The genus *Ædes* seems very limited in numbers; 2 species are found in Europe, the same in North America, and 1 is now described from Australia.

"Of the remaining genera belonging to the sub-family *Corethrina* very little is known out of Europe; *Corethra* has 2 species in North and 1 in South America, and about 8 species appear on the European list. *Mochlonyx*, as already mentioned, seems to be restricted to two or 3 species, all of which are European."

During the ten years that have elapsed since the publication of Skuse's paper, the number of new species of the family that have been described has not been large; while on the other hand, several revisions of the local representatives of the family in certain countries have resulted in a curtailment of the number of nominal species, so that the present total does not greatly exceed that given above.

In the present work are collated the descriptions of a total of 242 species, of which 18 belong to the genus *Megarhina;* 30 to *Anopheles;* 3 to *Psorophora;* 3 to *Sabethes;* 160 to *Culex;* 13 to *Ædes;* 12 to *Corethra;* and 3 to *Mochlonyx*.

Of these 72 are European, out of which 24 are recorded from England. From Continental Asia I find mention of 20 species. Out of these, exclusive of those mentioned for the first time in this connection, in this work, only some three or four had been recorded from India, while there can be but little doubt that the real number can not, at the least, fall far short of that of Europe. From the Asiatic

Islands, an unscientific grouping, it must be confessed, as Wallace's researches show that the fauna of these is Asiatic in some, and Australian in others, I find mention of 29 species; while Australasia, including Tasmania and New Zealand, thanks mainly to the work of Skuse, boasts of 32 described forms. From the entire African Continent, even including a couple of additions in the present work, only 16 species appear to have been identified, and it is needless to say that there must remain an enormous number of new and old species to be added to the list. In the New World, North America heads the list with 41 species, while the South follows close with 36, and the West Indian Islands with but 9. The probable total must far exceed these figures.

In three instances, the habitat is unknown.

One point that is very striking in these lists, is the vast distribution of certain species. *Culex tæniatus*, Meig., for example, appears to be found in all the warmer parts of the world, to as far north as Italy; and it may be strongly suspected that, under a variety of synonyms, *C. pipiens*, L. has an equally wide range for the cooler portions of the globe. As a corollary to this, it may be expected that other species may be found to be mere synonyms with widely distant habitats, but, in spite of this, the continuous discovery of genuine new forms may be expected to swell the list to a far greater extent for a long time to come.

The following lists give the recorded species as far as is known to me, from certain countries.

ENGLAND—24 SPECIES.

Anopheles bifurcatus, L.
— claviger, Fabr.
Culex annulatus, Schrank.
— annulipes, Meig.
— bicolor, Meig.
— calopus, Meig.
— cantans, Meig.
— ciliaris, L.
— detritus, Haliday.
— domesticus, Germar.
— fumipennis, Stephens.
— guttatus, Curtis.
— lateralis, Meig.
Culex lutescens, Fabr.
— nemorosus, Meig.
— ornatus, Meig.
— pipiens, L.
— punctatus, Meig.
— stiticus, Meigen, *fid.* Col. Brit. Mus.
Ædes cinereus, Meig.
Corethra culiciformis, Deg.
— pallida, Fabr.
— plumicornis, Fabr.
Mochlonyx velutinus, Ruthe.

EUROPE—72 SPECIES.

Anopheles bifurcatus, L.
— claviger, Meig.
— nigripes, Stæger.
— pictus, Loew.
— superpictus, Grassi.
— villosus, Desv.
Culex annulatus, Schrank.
— annulipes, Meig.
— articulatus, Rondani.
— bicolor, Meig.
— bipunctatus, Desv.
— calcitrans, Desv.
— calopus, Meig.
— cantans, Meig.
— ciliaris, L.
— detritus, Haliday.
— domesticus, Germar.
— dorsalis, Meig.
— fusculus, Zetterstedt.
— geniculatus, Olivier.
— glaphyropterus, Schiner.
— guttatus, Curtis.
— hortensis, Ficalbi.
— impudicus, Ficalbi.
— Kounoupi, Brullé.
— lateralis, Meig.
— leucacanthus, Loew.
— lutescens, Fabr.
— malariæ, Grassi.
— melanorhinus, Mihi.
— meridionalis, Leach.
— mimeticus, Noè.
— modestus, Ficalbi.
— nemorosus, Meig.
— Nicaensis, Leach.
— nigripes, Zetterstedt.
Culex nigritullus, Zetterstedt
— ornatus, Meig.
— pallipes, Meig.
— parvus, Macqt.
— penetrans, Desv.
— penicilaris, Rondani.
— phytophagus, Ficalbi
— pipiens, L.
— pulchripalpis, Rondani.
— pulchritarsis, Rondani
— punctatus, Meig.
— Richardii, Ficalbi
— rusticus, Rossi.
— salinus, Ficalbi.
— siculus, Desv.
— spathipalpis, Rondani.
— stiticus, Meig.
— tæniatus, Meig.
— thoracicus, Desv.
— vexans, Meig.
— vittatus, Bigot.
Ædes cinereus, Meig.
— rufus, Gimmerthal
Corethra culiciformis, Deg
— filipes, Gimm.
— flavicans, Meig.
— fusca, Stæger.
— gibba, Meig.
— Nyblæi, Zetterstedt.
— obscuripes, Van der Wulp.
— pallida, Fabr.
— plumicornis, Fabr.
— rufa, Zetterstedt.
Mochlonyx culiciformis (De Geer).
— velutinus, Ruthe.
— effœtus, Hal.

ASIA (Continental)—20 SPECIES.

Megarhina Christophi, Portschinsky (The Amur, Central Asia.)
— sp Mihi, Sikkim, India.
— splendens (Wied.), Singapore.
Anopheles Lindesaii, Giles, India.
— pictus, Loew, Coast of Asia Minor.
— Rossii, Mihi, India.
— sinensis, Wied., China.
— sp. *a.* } brought by Major Ross
— sp. *b.* } from Calcutta.
Culex albopictus, Skuse, Calcutta, India.
Culex annalutus, Schrank, Bukloh 5,000 ft, Punjab.
— calopus, Meig., Syria.
— caspius, Pallas, Central Asia.
— conopus, Frauenfeldt, China.
— dives, Schiner, Singapore.
— fatigans, Wied., India.
— fuscanus, Wied., Singapore.
— hircanus, Pallas, Central Asia.
— tæniatus, Meig., India.
— vagans, Wied., China.

ASIATIC ISLANDS (Malay and Papuan Archipelagoes)—29 SPECIES.

Megarhina Amboinensis, Doleschall, Amboina.
— immisericors, Walker, Makessar, Weigiou, Mysol, North Ceram.
— inornata, Walker, New Guinea.
— splendens (Wied.), Java, Sumatra, Batavia.
— subulifer, Doleschall, Amboina.
Anopheles annularis, Van der Wulp, Java.
— barbirostris, Van der Wulp, Java.
— vanus, Walker, Celebes.
Culex aureostriatus, Doleschall, Amboina.
— crassipes, Van der Wulp, Sumatra.
— dives, Schiner, Batavia.
— Doleschallii, Mihi, Java.
— filipes, Walker, New Guinea.
Culex fuscanus, Wied., Malacca, Sarawak, Borneo.
— impatabilis, Walker, Celebes.
— imprimiens, Walker, Amboina.
— laniger, Wied., Java.
— longipalpis, Van der Wulp, Sumatra.
— luridus, Doleschall, Java.
— molestus, Wied., Sumatra.
— nero, Doleschall.
— obturbans, Walker, Celebes.
— scutellaris, Walker, Celebes.
— sitiens, Wied., Sumatra, Celebes.
— setulosus, Doleschall, Java.
— variegatus, Doleschall, Amboina.
— ventralis, Walker, Amboina.
— zonatipes, Walker, New Guinea.
Corethra Manilensis, Schiner, Philippines.

AUSTRALASIA—32 SPECIES.

Megarhina speciosa, Skuse. (Queensland).
— sp. in Brit. Mus. Col. near M. ferox.
Anopheles annulipes, Walker (Tasmania).
— atratipes, Skuse.
— Mastersi, Skuse.
— musivus, Skuse.
— stigmaticus, Skuse.
Culex acer, Walker (New Zealand).
— albirostris, Macquart (New Zealand).
— alboannulatus, Macquart.
— alternans, Westwood.
— annulirostris, Skuse.
— argyropus, Walker (New Zealand).
— australis, Erichsen.
Culex Bancroftii, Skuse.
— camptorhynchus, Thomson.
— commovens, Walker.
— crucians, Walker (Tasmania).
— flavifrons, Skuse.
— hispidosus, Skuse.
— linealis, Skuse.
— Macleayi, Skuse.
— nigrithorax Meig. (Tasmania).
— notoscriptus, Skuse.
— occidentalis, Skuse.
— procax, Skuse.
— rubrithorax, Macqt. (Tasmania).
— sagax, Skuse.
— Skusii, Mihi.
— vigilax, Skuse.
— vittiger, Skuse.
Ædes venustipes, Skuse.

AFRICA—16 SPECIES.

Megarhina inornata, Walker, Natal.
Anopheles costalis, Loew, South Africa.
— funestus, Mihi, West Africa.
Culex agilis, Bigot, Algeria.
— annulitarsis, Macqt., Mauritius.
— calopus, Meig., Northern Coast.
— formosus, Walker, Sierra Leone.
— inexorabilis, Walker, West coast.
— longiareolatus, Macqt., Canaries.
Culex maculiventris, Macqt., Algeria.
— melanorhinus, Mihi, Egypt.
— mucidus, Karsch, Delagoa bay.
— pusillus, Macqt., Egypt.
— rufinus, Bigot, Tunis.
— sugens, Wied., Nubia.
— tæniatus Meig., West Coast, Natal, &c.

North America—41 Species.

Megarhina ferox (Wied.) *fide* Osten-Sacken.
— rutilla, Coquillett, Georgia, North Carolina.
Anopheles crucians, Wied., Pennsylvania, New Orleans.
— ferruginosus, Wied., New Orleans.
— quadrimaculatus, Say, Pennsylvania.
Psorophora Boscii, Desv., Carolina.
— ciliata (Fabr.), Carolina, Georgia.
Culex Bigotii, Bellardi, Mexico.
— Caspius, Pallas, *fide* Osten-Sacken.
— colon, Harris, Cat. Insec, Massachusetts (undescribed) ?
— excitans, Walker, Georgia.
— excrucians, Walker, Nova Scotia.
— fasciatus, Wied., as C. frater, Desv., *fide* Osten-Sacken.
— impatiens, Walker, Hudson's Bay.
— impiger, Walker, Hudson's Bay.
— implacabilis, Walker, Hudson's Bay.
— incidens, Thomson, California.
— inornatus, Williston, Argus Mountains, California.
— mosquito, Desv., *fide* Osten-Sacken.
Culex musicus, Say, Indiana.
— nigripes, Zetterstedt, Greenland.
— pinguis, Lord, British Columbia.
— pipiens, L., also as C. consobrinus, Desv.
— posticatus, Wied., Mexico.
— provocans, Walker, Nova Scotia.
— punctor, Kirby, Hudson's Bay.
— pungens, Wied., Massachusetts.
— rubidus, Desv., Carolina.
— rutilla, Coquillett, North Carolina and Georgia.
— signifer, Coquillett, District of Columbia.
— solicitans, Walker, United States.
— stimulans, Walker, United States.
— tæniatus, Meig., Savannah.
— tæniorhynchus, Wied., and as C. perturbans, Walker.
— tarsalis, Coquillett, California.
— territans, Walker, United States.
— testaceus, Van der Wulp, United States.
— triseriatus, Say, Pennsylvania.
Ædes fuscus, Osten-Sacken, Massachusetts.
— saphirinus, Osten-Sacken, United States.
Corethra punctipennis, Say, Pennsylvania = Cor. trivittata, Loew

West Indian Islands—9 Species.

Megarhina Portoricensis, Von Röder.
— splendens, Wied.
Anopheles albimanus, Wied.
Culex fasciatus, Fabr.
— mosquito, Desv.
Ædes pertinans, Williston
— purturbans, Williston.
— splendens, Williston.
Corethra punctipennis, Say.

SOUTH AMERICA—36 SPECIES.

Megarhina ferox, Wied., Brazil.
— hæmorrhoidalis, Fabr., Brazil, Argentina.
— separata, Arribálzaga, Argentina.
— trichopygus, Wied., Brazil.
— violacea, Hoffmanseg, Brazil.
Anopheles albitarsis, Arribálzaga, Argentine coast.
— annulipalpis, Arribál., Argentina.
— argyrotarsis, Desv., Brazil.
Psorophora ciliata (Fabr.), Honduras, Argentina.
— Holmbergii, Arribál., Argentina.
Culex Æstuans, Wied., Brazil.
— albifasciatus, Macqt., Brazil, Chili, Argentina.
— autumnalis, Weyenburg, Rio Primiero (descr. not obtainable).
— cilipes, Fabr.
— cingulatus, Fabr.
— confinnis, Arribál., Argentina.
— confirmatus, Arribál., Argentina.
— cyaneus, Fabr.
Culex discrucians, Walker, Argentina.
— dolosus, Arribál., Argentina.
— exagitans, Walker, Para.
— fasciolatus, Arribál., Argentina.
— flavicosta, Walker, The Amazon region.
— longipes, Fabr., Brazil, Guyana, Argentina (Sabethes).
— oblitus, Arribal., Argentina.
— ochripes, Macqt.
— perterrens, Walker.
— scintilans, Walker, Para. (Sabethes).
— tæniorhynchus, Wied., Brazil, Argentina.
— terrens, Walker.
— tibialis, Desv., Brazil.
— toxorhynchus, Macqt., Brazil, Chili.
— trichopygus, Wied., Brazil.
Ædes nataliæ, Arribál., Argentina.
— pulcherrimus, Arribál., Argentina.
— squamipennis, Arribál., Argentina.

HABITAT UNKNOWN—3 SPECIES.

Culex concolor, Desv.
viridifrons, Walker.
Ædes obscurus, Meig.

An examination of the foregoing faunistic lists makes it apparent, that while in Europe the group has received so much attention that the family is overburdened with a number of nominal species, which are probably no more than ill-described synonyms of established species, they have not in many other countries received anything like the attention that one would naturally expect them to excite.

These lists should be taken as mere abstracts of the species enumerated in the following pages and do not pretend either to be complete or to include synonyms.

PLATE V.

Fig. 1.—Head of *Anopheles Rossii*, mihi ♂.

Fig. 2.—Head of *Anopheles Rossii*, mihi ♀.

Fig. 3.—Head of *Megarhina* ♂.

Fig. 4.—Head of *Culex* ♂.

Fig. 5.—Head of *Culex pipiens* ♀.

Fig. 6.—Head of *Ædes pulcherrimus* ( ) *Uranotænia Arribál.* ♂.

Fig. 7.—Head of *Ædes* ♂.

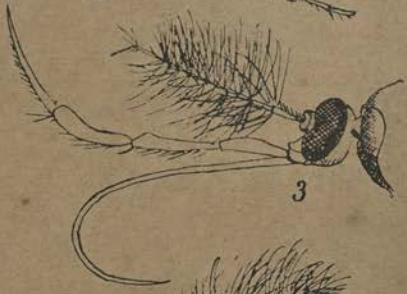
Fig. 8.—Wing of *Culex discrucians*.

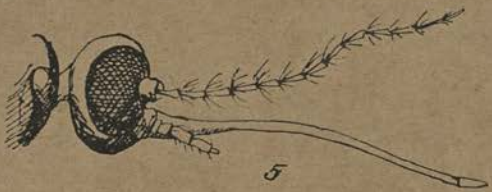
Fig. 9.—Wing of *Anopheles claviger*.

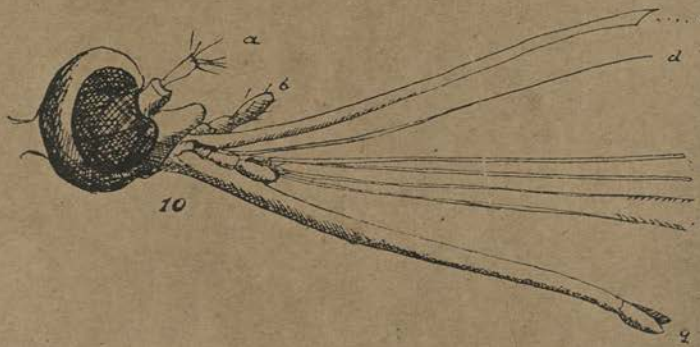
Fig. 10.—Head of *Culex pipiens* ♀, to show mouth parts: *a*, antenna; *b*, palp; *c*, labrum; *d*, hypopharynx; *e*, mandibles; *f*, maxillæ; *g*, labium.

Fig. 11.—Foot of *Culex pipiens* ♀: *a*, last tarsal joint; *b*, claws; *c*, plumiform empodium.

The figures in this plate are partly original, and partly derived from Arribálzaga and Ficalbi.

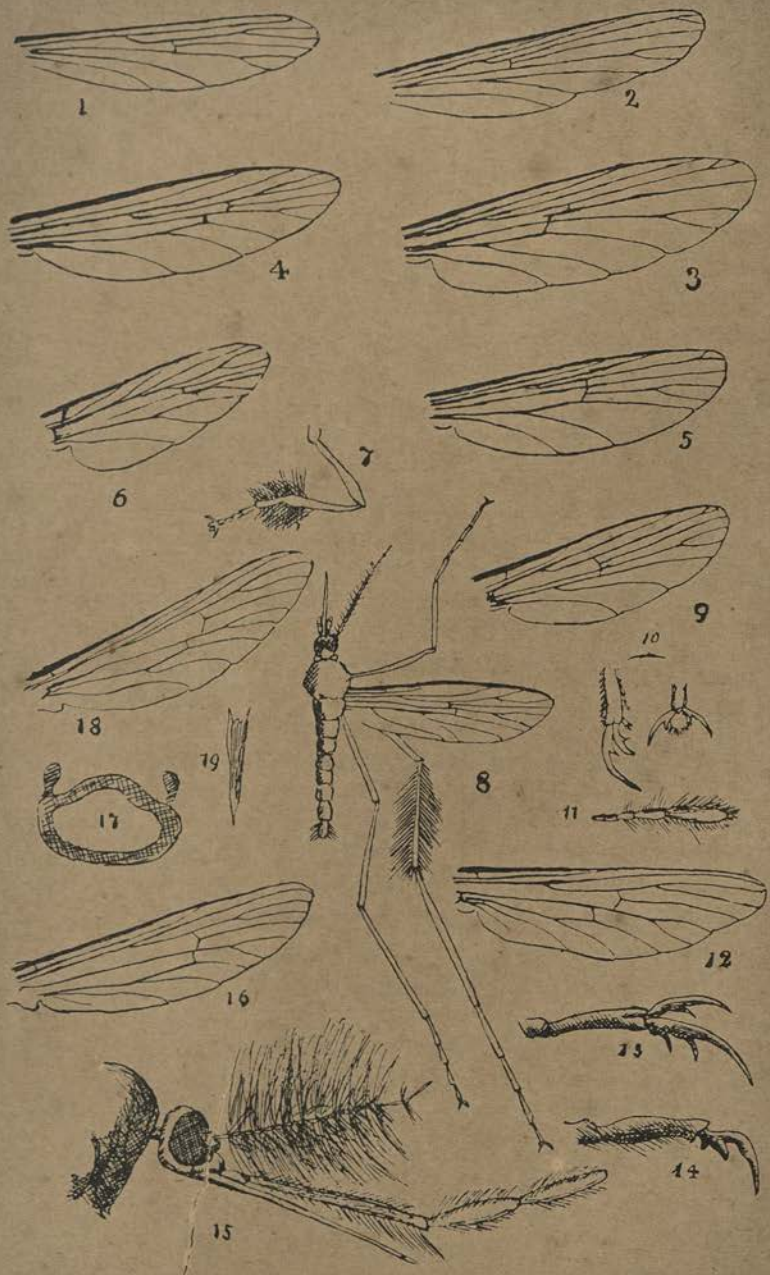






Bals and Danielsson, Imp.

PLATE VI.



Bale and Danielsson, Imp.

PLATE VI.

Fig. 1.—Wing of *Ædes* (*Hæmagogus*) *splendens*, Williston.
Fig. 2.—Wing of *Megarhina Portoricensis*.
Fig. 3.—Wing of *Megarhina splendens*.
Fig. 4.—Wing of *Culex Doleschalii*.
Fig. 5.—Wing of *Megarhina hæmorrhoidalis*.
Fig. 6.—Wing of *Sabethes longipes*.
Fig. 7.—Hind leg of *Sabethes remipes* ♂.
Fig. 8.—Half figure of *Sabethes longipes* ♀, showing arrangement of cilia on the middle leg.
Fig. 9.—Wing of *Megarhina ferox*.
Fig. 10.—Feet, ♂ and ♀, of *Culex discrucians*, Walker.
Fig. 11.—Palpus of the same ♂.
Fig. 12.—Wing of the same.
Figs. 13 and 14.—Feet of *Psorophora ciliata*, Macq.
Fig. 15.—Head of the same.
Fig. 16.—Wing of the same.
Fig. 17.—Diagrammatic section of thorax of the same (after Desvoidy).
Fig. 18.—Wing of *Culex tæniorhynchus*.
Fig. 19.—Wing scale of the same.

The figures of this plate are derived from a variety of sources.

PART II.—SYSTEMATIC.

In the following pages will be found descriptions of all the species which I have been able to trace.

As a rule I give the original description, supplemented in some cases by my notes on the types in the Jardin des Plantes and British Museum. Where, however, previous authors have been at the pains to collect the descriptions of the species appertaining to particular localities, I have followed the descriptions given in these monographs.

The descriptions of the European species, for example, have been taken from Ficalbi's "Revisione"; those of Australia, from Skuse's monograph; and those of the Argentine Republic from Arribálzaga's work on the subject.

In each genus the series of descriptions will be found to be preceded by a table, intended to serve as a key to the ready identification of the species belonging to it; and the species will be found to be arranged in the same order as they fall in the table.

The plan of these tables is based on that adopted by Ficalbi for the European species, but has been somewhat modified owing to the much larger number of species that have to be accounted for.

It must be, however, distinctly understood that tables of this sort can only be employed as a sort of convenient index to facilitate the ready identification of species, and neither are nor pretend to be, in any sense a natural classification. At the same time, as a matter of fact, although occasionally species will be found to be inconveniently separated from their nearest allies, the plan adopted generally places closely allied species in fairly consecutive order.

The general principle of the tables is to place first the

most elaborately adorned species, and to relegate those that are uniformly tinted to the end. The difficulty of contriving a table of this sort is greatly enhanced by the utterly inadequate character of many of the descriptions, and owing to this it has been necessary to place aside, in each subdivision, a number of species in which we are left with no information on the point in question. For example, taking the species in which there is a note that the tarsi are adorned with lighter bands, which form roughly a half of the entire number, it is clear that these bands may be (1) at the base of the joints, or (2) at their apices, or (3) in their continuity, or (4) the banded appearance may be produced by certain joints being wholly light and others entirely dark. In a fairly considerable number of cases, however, we are left in doubt as to the relative position of the bands, and hence, though in this and similar cases, it is obvious that the species must really belong to one or other of the specified categories, they have necessarily been placed in a separate doubtful section by themselves. Hence, where a species cannot be traced in any of the well-defined groups, it will be necessary to compare it carefully with these doubtfully placed species.

The earlier entomologists framed their descriptions so as to distinguish between the dozen or so of species alone known to them, and probably in no way foresaw the immense number that would be added by subsequent observers.

Hence, in all but a few species that are so common that a sort of tradition as to their identity has been handed down, there must always remain a doubt as to the identity of the specimens subsequently referred to the names they gave, and even in the case of that commonest of all species, *Culex pipiens*, it does not appear to be by any means certain that the species commonly so spoken of in England and Southern Europe is really identical with the Scandinavian species described by Linnæus.

Before proceeding to attempt to trace out a species of the genus *Culex*, for example, the following points should first be noted on a scrap of paper.

(1) Whether the wings are spotted or unspotted. If spotted, the number and position of the spots, and whether due to differences of colour or merely to local accumulations of scales.

(2) Whether or not the tarsal joints are adorned with lighter bands, and if so adorned the exact position of the markings.

(3) Whether the thorax is adorned with markings, and if marked, whether the marks are light on a darker ground, or *vice versâ*, as well as the character and position of the marks, or the colour of the part if uniformly coloured.

(4) Whether or not the abdomen is adorned with marks or cross-bands, and if so, their character and position, especially the relative position of lighter cross-marks on the segments.

With these points carefully noted, I hope that even the amateur entomologist may be able to determine the position of any species he may take.

In referring any given specimen to an incompletely described species where the type specimens are not available, considerable importance must be attached to habitat; for where it is found to correspond, as far as it goes, to the description of a species previously described from the same locality, the more preferable course seems to assume the identity, and to supplement the original description by additional notes. There can, for example, I consider be no practical doubt that the common Indian Mosquito, which has lately been brought into prominence through Major Ronald Ross's researches on Proteosoma, and which he distinguishes as the "grey" Mosquito, is really Wiedemann's *Culex fatigans*, for the type was originally received from India, and this "grey" Mosquito corresponds very closely to the few points noted in the original description.

On the other hand, although his "Dapple Wing" is certainly very close to *Anopheles costalis*, Loew, there are several points in which it fails to correspond with the description of that species, and when the wide difference of habitat is added to this, I am constrained to conclude that they are not identical, and that hence Ross's species is new to science.

For similar reasons I hesitated to identify Ross's "brindled" Mosquito with *C. tæniatus* from America, but the examination of the large amount of material shown me by Mr. Austen has convinced me that, in spite of discrepancies from the description, I can only agree with him that they belong to that species.

At the same time, it is a mistake to attach too great importance to habitat, as where there is continuity of land many species are well known to have a very wide distribution, and the habits of these insects often lead to their being carried across the seas in company with their victim —man.

Genus I. **MEGARHINA** (R. Desvoidy).

The genus Megarhina forms a very natural group, the general appearance of which is so characteristic that its members can be recognised at a glance, once one has become familiar with a few species. They are all comparatively large insects, the smallest of them being a good deal over the average size of the family, and are generally conspicuous for their brilliant metallic colouring, of green, gold, and violet, some of them rivalling the well-known "diamond beetles" in their gorgeous reflections. The apex of the abdomen is usually broadened in appearance by a pair of large lateral, subterminal tufts of hairs, which are commonly brilliantly coloured, often in effective contrast with the hairs that fringe the end of the abdomen in the middle. Another peculiarity is that the proboscis, which is always large, is bent downwards, almost into a hook. In length the palpi resemble those of *Anopheles*, being as long or longer than the proboscis in both sexes, but they differ in the terminal joint being subulate, instead of club-shaped.

Although the number of species is not large they are widely distributed throughout the tropical and sub-tropical regions, and are essentially forest insects, never being found

in houses. The general opinion is that they do not bite, at any rate, human beings, but the names of some show that they have been reported as troublesome.

The following is the formal definition of the genus :—

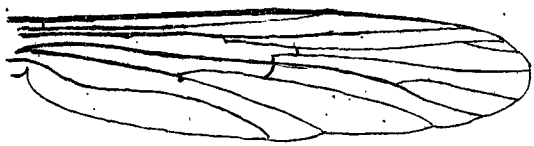
Desvoidy, "Essai sur les Culicides, Mém. Soc. d'Hist. Nat. de Paris," iii, 1827, p. 412; Macquart, "Diptèra Exotica," vol. i, 1838, pl. i., fig. 1. (Extracted from F. A. A. Skuse. "Proc. Linn. Soc.," N. S. W., 1889, p. 1720).

Proboscis bent downwards about the middle of its length; in the male almost the length of the body, in the female a little shorter. Palpi in the male a little longer than the proboscis; the first joint short; second, third and fourth elongate and cylindrical, of equal length, except the second which is a little shorter; in the female a little shorter than the proboscis with five cylindrical joints of nearly equal length. Antennæ in the male with bushy plumes, the second joint a little elongate; in the female the joints elongate, with a few long hairs at the base. Prothorax projecting from each side in the form of a scale; bordered with hairs in the male, naked in the female. Abdomen: the three last segments bordered laterally with hairs in the male; the copulatory organ accompanied by two appendages terminating in a point. Wings: first marginal cell very small; transverse veins very remote from the petiolated cells.

Skuse's original remarks on the characters of the wing, drawn from *M. speciosa*, are also transcribed with the view of comparison with his remarks on other genera.

Wings longer than the abdomen, incumbent in repose; auxiliary, first and basal half of fifth longitudinal, densely clothed with more or less turbinate scales. Humeral and subcostal transverse veins present, the latter placed at the middle of the auxiliary. Marginal cross vein present, the second longitudinal appearing before it in the first basal cell in an ill-defined manner like an incrassation of a wing-fold. Second longitudinal ending in a very small fork with a cuneiformly narrowed base, both branches bent slightly forward at the end in the ♂. Third, not springing from the second longitudinal but joined to it by a supernumerary

cross-vein, and starting at the middle transverse which is placed much before the latter and exactly opposite the posterior transverse. In both sexes the third longitudinal appears to traverse the first posterior cell to its base as a doubtful incrassation of a wing-fold, but in the ♀ available, the third longitudinal is scaled for some distance before the



Typical Wing of Genus *Megarhina*.

middle transverse. Fourth longitudinal with a long fork cuneiformly narrowed towards the base, the anterior branch bent back at its tip in the ♂. Fork of the fifth longitudinal very long, its base placed some distance before the subcostal transverse. Sixth longitudinal rather sinuous, joining the margin beyond the posterior, and in the ♀ opposite the supernumerary transverse.

Table of the Species of the Genus MEGARHINA.

A. With the caudal tufts red and black.

II. The tarsi with some joints marked whitish.

1. *M. hæmorrhoidalis* (Fabr.) Third joint of the palpi much longer than the fourth.
2. *M. separata*, Arribálzaga. Third joint of the palpi as long as the fourth. Tarsi not specially described.

B. With the caudal tufts more or less yellow and black.

I. The tarsi with certain joints or bands whitish.

3. *M. splendens* (Wied.) Thorax whitish.
4. *M. subulifer*, Doleschall. Thorax brown with greenish gold scales; anterior margin of the wing metallic blue-scaled.
5. *M. speciosa*, Skuse. Thorax brown with greenish scales; margin of wing pale.
6. *M. immisericors*, Walker. Thorax metallic green; scales on costa blackish.
7. *M. christophi*, Portschinsky. Thorax black with metallic blue scales.
8. *M.* sp., from Sikkim. Thorax chocolate-coloured, with a greenish lustre.

9. *M. rutilla*, Coquillett. Thorax brown with golden and violet scales and pale yellow margins.

II. With the tarsi uniformly coloured.

10. *M. violacea* (Hoffmansegg.) Thorax fuscous.

C. Caudal tufts steel-blue and white.

I. The tarsi with certain joints or bands whitish.

11. *M. Portoricensis*, Von Röder. Thorax bay, with green gold scales.

D. Caudal tufts showing no contrasted colours.

I. Tarsi with certain bands or joints whitish.

12. *M. amboinensis*, Doleschall. Thorax dark with glittering golden scales; abdomen steel-blue.

13. *M. trichopygus* (Wied.) Thorax black with greenish golden scales; abdomen brown.

14. *M. ferox* (Wied.) Thorax chestnut; abdomen steel-grey.

II. With the tarsi uniformly coloured in the ♂, adorned in the ♀.

15. *M. inornata*, Walker. Generally of dark and sober coloration.

1. MEGARHINA HÆMORRHOIDALIS (Fabr.)

Caudal tufts blood red, with black hairs between them. Fourth joint of palpus between two and three times as long as the third. Tarsi with white markings on hind and middle legs. Plate vi., fig. 5.

Culex hæmorrhoidalis.—Fab., "E. S.," 401, 5; and Fab., "S. A." 25; Wied., "D. E." p. 6; and "A. Z. I." p. 2; Macqt., "H. D." p. 33.

Meg. hæmorrhoidalis.—Desv., "Essai," p. 412; Macqt., "D. E." p. 32; Rondani et Baudi, "In Truqui. Studi. Entom.' p. 108; Walker, "List" p. 1; "L. A." p. 32.

Description from Wied., "D. E." p. 6.—Steely-blue, anal end of the abdomen with a tuft of blood-coloured hairs on either side. Length, without proboscis, 9 to 10 mm.

Fabricius, "E. S.," iv, 401, 5, gives the following diagnosis:—Fuscous, margin of abdomen at apex, rufous-ciliate, very large for this genus; antennæ very densely verticillately-pilose, fuscous, with the first joint nude, glistening blue; rostrum porrect between the antennæ, with bivalve sheath, the valves obtuse, lancet acute; head fuscous, glistening blue on the apex; thorax elevated, fuscous, with the anterior margin and point in front of the wings glistening blue; abdomen fuscous, with the apex

plane, its margin strongly rufous-ciliate; feet blue, shining, with the femora testaceous below; wings white, with a fuscous costa. Antennæ fuscous; palpi steel coloured; eyes dull silvery, frons and vertex glistening emerald and copper colour; thorax steel-grey and glistening green; pleuræ ferruginous; scutellum dull yellow; abdomen steely, with ferruginous spots on either side, and forming an interrupted middle line, sides pilose, grey with silvery spots; from thence, from the apex of the fifth segment, blood-red ciliate; belly silvery with a yellow covering; wings limpid, fuscous-veined; halteres whitish, with a fuscous head; feet steely, femora silvery below. It is to be noted that the metallic colours are produced by tomentum and scales on prominent points.

This species appears to be widely diffused throughout South America. There are specimens in the British Museum from several distant States. The anterior fork cell is, as is usual in the genus, small but not so minute as in *M. ferox*.

Habitat.—Brazil, Cayenne, Chaco in Formosa, Argentina.

2. **MEGARHINA SEPARATA**, Arribálzaga.

Caudal tufts blood-red, with violet-black hairs between them; fourth joint of palpus equal in length to the third.

Description from "L. A.," p. 33.—Three specimens ♂. Closely resembling the preceding, but rather smaller; the disc of the thorax with dusky scales; the third and fourth joints of the palpi nearly equal; antennæ and its plumes dusky, the basal joint with steel-blue scales and a deep brazen ring; head dark steely, almost blue on the vertex; proboscis blue-black; palpi with the first four joints brick-red below and at the sides, steely above and at the apex, the last joint steely throughout. Prothorax blue above and golden at the sides; mesothorax nearly black above, with deep steely scales; the shoulders, posterior corners, and scutellum clothed with green and blue scales; pleuræ pitch

brown, densely covered with silvery scales; legs steely, the femora pale orange-tinted below; wings limpid, with dusky scales which are dense in front and sparse behind; abdomen with the first three or four segments greenish blue above and golden at the sides, the rest steely-purple but with the two penultimate segments with a dense tuft of blood-red hairs on either side, beneath golden, with a steely-purple median longitudinal line. Length (without the proboscis) 8½ to 9 mm.

Habitat. — Southern Chaco in Formosa, Argentine Republic.

3. **MEGARHINA SPLENDENS** (Wied.).

Caudal ornamentation yellow and black; the tarsi with certain bands or joints whitish; thorax mainly white. Plate vi., fig. 3.

Culex splendens, Wied., "D. E.," p. 7, and "Zool. Mag." iii., 2, No. 1.

Antennæ very dark fuscous; palpi steely, made up of four nearly equal joints, with the fifth (last) subulate and quite free from hairs; head with metallic green and gold tomentum or scales; thorax whitish; pleuræ whitish, shaggy; abdomen steely, the bases of the segments violescent; belly golden on either side; sides of the abdomen whitish ciliate, the last two segments with longer and denser nigro-fuscous cilia; anus with gold-coloured cilia; wings somewhat yellow, with dusky yellow veins; halteres yellowish; feet steely, the bases of the femora hairy and yellowish. No white on the tarsi of the front legs; the first and second joints of the middle legs and the second of the hind legs whitish.

Note by Dr. J. R. Schiner, "Reise der Novara. Dipt.," p. 31. — The expedition obtained a female from Batavia, which agrees in the main with the above description. The antennæ are, however, not brownish black but yellow; the sides of the abdomen not golden but silver white; and the abdomen not as above, but absolutely violet, with a red ground tint particularly evident on the last segment.

He regards these differences as of no great importance, more especially as Wiedemann's description is based on a male specimen. As supplementary points, he notes that the thorax and pleuræ are golden-green scaled, and that two brighter bands stand out distinctly on the middle femora. The fork of the radial vein is, even for this genus, strikingly short.

Note by F. M. Van der Wulp, "Dipt. der Midden Sumatra," p. 8.—The expedition obtained a single female from Rawas. The author remarks, "The specimen I have before me agrees well with Schiner's description, although it is not a particularly good one, most of the scales being rubbed off the body. They are preserved on the pleuræ, and are there of a glistening silver; the metallic colours of the body are magnificent; the proboscis, of which a piece is missing is exceptionally thick, and glittering copper red, tending to a purple colour; the eyes meet above the antennæ. The venation of the wings of the genus Megarhina is characterised not only by the striking shortness of the upper 'fork-cell,' but more especially by the rectangular base of the cubital vein and the equally marked rectangular bend in the middle vein. At the angle there is a small hairy process, which makes the cubital vein look as if it sprang from the discoidal vein through the intermediation of a small transverse vein; the base of the cubital vein is regularly united with the radial vein. I find that these characters are present in the two species of the genus known to me, viz., *M. hæmorrhoidalis* Fabr. from the West Indies, and in *M. splendens* (Wied.)." Length, 10 mm.

Habitat.—Java, Sumatra, Batavia; also found at Singapore, by Wallace "Proc. Linn. Soc.," I. (1857), p. 5.

4. **MEGARHINA SUBULIFER**, Doleschall.

Caudal ornamentation yellow and black. The tarsi with certain bands or joints whitish; thorax brown with greenish gold scales; anterior margin of wing metallic blue scaled.

Certain authorities have regarded this species as a synonym of *M. amboinensis*, Dol., but as Doleschall who originated both species, is at pains to emphasise the differences between them, it appears more probable that they are really distinct species.

Description from Doleschall, "Natuurkundig Tijdschr. voor Nederlandsch Indië." Deel XIV., p. 382.—Proboscis strongly built, long; thorax fuscous, with golden green scales; the two last segments of the abdomen with dense lateral hairs, the three front segments metallic green, the rest blue; anus with golden yellow hairs; legs black, all the tarsi broadly banded white; anterior margin of the wings blue scaled. Length, 2½ lines (Dutch).

The disproportionately large proboscis, which is thick and bent downwards in the middle, at once catches the eye, and is, I believe, quite peculiar among Eastern species. The two not particularly good specimens examined, bear a close resemblance to *M. amboinensis*, but may readily be distinguished from that species by the following characters. The palpi of the females are short, curved upwards, slightly hairy, and, like the eyes and antennæ, black. The hind border of the head partly glittering metallic green. The thorax is high and oval in outline, and exhibits in front, what (from the figure accompanying the description) appears to be humeral, prothoracic lobes, of a dark brown colour, ornamented with shining, golden-green hairs. The scutellum, and three first abdominal segments green. The abdomen flat, with the last two segments armed on either side with long black hairs, mixed with a few white ones; from the fourth to the eighth segments blue, the end of the abdomen with orange-coloured hairs. The legs black, moderately long and not particularly hairy; the hindmost tarsus longer than the others. In the front and hind tarsi, one part of the tarsus is white, while there are two broad bands on that of the middle pair. Wings somewhat shorter than the abdomen, with brownish black veins, the anterior border partly ornamented with green scales.

Habitat.—Amboina; less common than *M. amboinensis.*

5. **MEGARHINA SPECIOSA,** Skuse (W. Macleay, MS.).

Description from "S. A. C.," p. 1722.—Caudal ornamentation yellow and black. Tarsi with certain bands or joints whitish; thorax brown with greenish scales; margin of wing pale. ♂.—Length of antennæ 4·06 mm.; expanse of wings 8·39 × 1·54 mm.; length of body 11·17 × 2·02 mm.

Antennæ brown, a little more than half the length of the palpi; basal joint black, with hoary reflections; second joint more than twice the length of the third, ornamented with some beautifully iridescent scales, the whorl of very long hairs placed about one-third from the apex. Head covered with brilliant margaritaceous scales, chiefly reflecting green; in a certain light appearing brown, with a bright pale greenish line round the hinder border of the eyes. Proboscis (0·3 mm.) somewhat longer than the palpi (0·285 mm.) deep metallic blue, with a deep purplish reflection before the bend, brown beyond. Palpi deep metallic blue, with purplish reflections, the third joint ringed with golden-yellow at the apex, most distinctly so beneath, and the fourth with a broader ring of the same beyond the middle. Thorax brown, with the lateral margins and prothorax densely covered with pale greenish scales, the latter with long brown hairs; pleuræ with a naked brown stripe from the origin of the wings to the scale-like, prothoracic projection, below this densely covered with silvery scales; metanotum brown, naked. Halteres ochre-yellow. Abdomen about twice the length of, but narrower than, the thorax, flat, deep metallic blue, except the first segment, the latter green with a yellow patch on each side; fifth segment showing some golden-yellow laterally, sixth and eighth segments ornamented with a strong tuft of golden hair laterally; the seventh with black tufts; all the segments slightly bordered with golden hairs at the sides; the first to third and fifth to seventh segments golden-yellow beneath with a metallic blue longitudinal stripe down the centre, fourth entirely metallic blue and the terminal one brilliant pale green. Coxæ clothed with silvery scales. Femora and tibiæ metallic violet, the former golden-yellow

beneath. In the middle and fore legs the first joint of the tarsi white, except at the base, and the second also, except at the apex; the rest metallic violet. Wings longer than the abdomen, with a pale brownish tint in front, and along the fifth longitudinal vein, veins pale brown, cilia pale and short; weak reflections. Auxiliary vein joining the costa almost opposite, but somewhat beyond the tip of the posterior branch of the fifth longitudinal; sub-costal cross-vein distinct, situated about midway between the origin of the anterior branch of the fifth longitudinal and the origin of the second longitudinal vein; fork of the latter very small, the tips of the branches slightly bent in front; supernumerary cross-vein equal in length to the middle cross-vein; posterior cross-vein more than twice the length of the latter, rather sinuous; tip of the anterior branch of the fifth longitudinal joining the margin opposite the middle of the second posterior cell; a very prominent wing-fold running close to the posterior side of the fifth longitudinal for the whole of its length, and another on the anterior side of the anal cell.

Skuse gives also the following characters, which he believes to be of generic value, or generically exceptional. Head small, sub-globose, free from the thorax. Eyes lunular, emarginate at the insertion of the antennæ, more closely approximated above in the ♀ than in the ♂. Palpi, in the ♂ a little shorter than the proboscis, densely clothed with scales, six jointed; the first two joints very short, the third, fourth and fifth elongate and cylindrical, the fifth somewhat longer than the third and the fourth somewhat longer than the fifth, the sixth twice as long as the fifth, acuminate. Proboscis, in both sexes, as long as the abdomen and half the thorax, densely clothed with scales. Antennæ 2 × 12 jointed; thorax ovate, much more pointed in front than in *Culex;* prothoracic lobes bordered in both sexes with hairs; scutellum more oblong than in *Culex.* Abdomen flattened, sub-claviform, with eight segments, the last three bordered in both sexes with dense, long hairs laterally. Legs long, slender, minutely spinulose; coxæ short, wings incumbent in repose; auxiliary

first longitudinal, and basal half of the fifth longitudinal vein densely covered with more or less turbinate scales. Humeral cross-vein and sub-costal vein present, the latter placed at the middle of the auxiliary vein. Marginal cross-vein present, the second longitudinal appearing before it in the first basal cell in an ill-defined manner, like an incrassation of a wing-fold. Second longitudinal terminating in a very short fork, which is narrowed at the base. Third longitudinal not originating from the second, but joined to it by a supernumerary cross-vein, and starting at the middle cross-vein, which is placed much before the latter and exactly opposite the posterior cross-vein. Fourth longitudinal with a long fork, narrowed at the base, the front branch slightly bent back at its tip in the ♂. Fork of the fifth longitudinal very long, its base placed some distance before the sub-costal transverse. Sixth longitudinal somewhat sinuous, joining the margin beyond the posterior transverse, in the ♀ opposite the supernumerary cross-vein.

Habitat.—Port Denison, Queensland (Masters).

6. **MEGARHINA IMMISERICORS,** Walker.

Caudal adornment yellow and black. Tarsi with certain bands or joints whitish; thorax metallic green; scales on costa blackish.

Description from Walker, "Journ. Proc. Linn. Soc.," Lond. IV. (1860), p. 91.—Male, black; head and thorax with green metallic scales; proboscis, palpi, and legs purple; femora tawny beneath; middle tarsi with two white bands; hind tarsi with one white band; pectus silvery; abdomen blue, widening from the base to the tip, with small white tufts of hairs along each side; four larger black subapical tufts, two gilded apical tufts. Wings slightly greyish, blackish along the costa; veins black. Length of the body 5 lines; of the wings 8 lines.

In the type in the British Museum, the caudal brush consists on either side of two lateral tufts of dark metallic blue fairly separate from each other; then a small brownish-golden tuft, and lastly, in the middle, a minute dark one. The anterior fork cell is small, but not so minute as in *M. ferox*. In addition to the type there are specimens of this species from Upper Burmah, and from Pundalnoy in Ceylon.

Habitat.—Makessar, in the Celebes. Also at Weigiou, Mysol, and North Ceram. Vide "Proc. Linn. Soc." VII., p. 202.

7. **MEGARHINA CHRISTOPHI,** Portschinsky.

Caudal adornment yellow and black. Tarsi with certain bands or thorax whitish; thorax black with metallic blue scales.

Description from "Horæ Soc. Ent. Rossicæ," 1883-1884, p. 122.—Proboscis long and black, but distinctly shorter than the body; antennæ fuscous and barely half the length of the proboscis, provided with scanty black hairs; their first joints, and the circumference of the eyes clothed with glistening, silvery blue scales; entire body black, closely covered with glistening blue scales; the abdominal segments, from the first to the sixth inclusive, ornamented with a glistening, silvery, transverse stripe; the sixth segment provided behind with a brush of black hairs, and the last two segments with long, fulvous, marginal hairs on either side. The legs fuscous, with paler bases to the femora; the first and second joints of the anterior tarsi, the base of the first joint, and the whole of the second and third joints of the middle, and the second joint of the hind tarsi, all white: wings nearly hyaline; halteres, fuscous. Length 5½ lines Russian) ♀.

Habitat.—The Amur (Central Asia).

8. **MEGARHINA** (Sp. from Sikkim).

Caudal adornment yellow and black. Tarsi with certain joints or bands whitish; thorax chocolate coloured, with a greenish lustre.

In the British Museum there is an apparently undescribed species of this genus, a ♀, numbered 233, and marked as having been sent by Mr. A. G. Dudgeon, in June 1896, taken at an elevation of 1,800 ft. in the Himalayas. The following short description may suffice for its recognition, should other specimens be met with:—Antennæ wanting, except part of one which is dark brown, with whitish tomentum; palpi metallic violet and purple; proboscis metallic violet, with greenish and golden scales intermixed. Thorax very large, ovoid, with the pointed end forwards, dark chocolate coloured, greenish in certain lights; pleuræ generally lighter than the rest of the thorax, with a few scattered bright blue and green scales. Fore legs wanting on both sides; in the remaining pairs the femora are covered with scales of a more or less metallic violet, as also are the tibiæ; in the hinder pair, the second tarsal joint is almost entirely whitish throughout, with a little black at the apex, while the tarsus of the middle pair is much paler, being of a light yellowish-brown throughout; Wings hyaline, shorter than the abdomen, with brown veins, the first submarginal cell very minute. Abdomen with the three anterior segments dorsally bright metallic green, followed by three of a clear metallic blue, with indistinct paler violet, partly denuded bands; all segments more or less fringed laterally with golden hairs, and the last two, with a sort of aureole of long golden hairs, relieved by dense, velvety black tufts of long hairs on either side.

9. **MEGARHINA RUTILLA** Coquillett.

Caudal adornment yellow and black. Tarsi with certain joints or bands whitish; thorax brown with golden and violet scales, and pale yellow lateral margins.

Description from the "Canadian Entomologist," 1896, p. 43. ♂.—Head black, tomentum of the occiput blue in the centre, white next the eyes; antennæ brown, the first joint covered with blue tomentum on the outer side, that on the inner side silvery white; hairs of antennæ dark grey, their bases brown; proboscis and palpi black, covered with appressed blue, golden, and white tomentum. Thorax brown, its tomentum golden brown and violet, that on the lateral margins pale golden; humeral angles, and two large spots on the pleuræ covered with golden tomentum, scutellum covered with blue-black and golden tomentum; abdomen black, its tomentum blue, becoming violet at the tip, that on the lateral margins golden, the venter with blue scales, mixed with a few golden ones; sides of the abdomen bearing a few short, pale yellow hairs; legs black, the tomentum mixed blue, violet and golden, that on the coxæ, and on the apices of the femora entirely golden; second joint and the base of the third of the fore and middle tarsi, with the fourth joint and the base of the hind tarsi, white; one claw each of the fore and middle legs toothed, the others simple; wings hyaline, costal margin and veins brown, the scales blue and violet. ♀.—As in the ♂, except that the first joint of the antennæ is destitute of the blue and silvery tomentum; second, third, and base of the fourth joints of the fore and middle tarsi white, claws simple. Length 7 to 10 mm.

Habitat.—North Carolina and Georgia.

10. **MEGARHINA (?) VIOLACEA** (Hoffmansegg).

Culex violaceus, Hoffmansegg.

Caudal tufts yellow and black (?). Tarsi uniformly coloured; thorax fuscous.

Description from Wied., "D.E.," p. 7.—Steel-coloured, with a fuscous thorax; sides of the abdomen golden-yellow; tarsi without any white markings. Somewhat resembles *M.* (*C.*) *splendens*, Wied., but differs from it in its smaller size,

in the thorax being fuscous rather than grey, and in the tarsi being uniformly coloured.

Length (♂) $3\frac{2}{3}$ lines.

Habitat.—Bahia, in Brazil.

11. **MEGARHINA PORTORICENSIS,** Von Röder.

Caudal adornment steel-blue and white. Plate vi., fig. 2.

Description from Von Röder, "Entomolog. Zeitung, Stetin," 1885, p. 337.—Thorax bay-brown, with green-gold scales; abdomen, legs and palpi steel-brown; penultimate joint of the hind tarsi silver-white.

Length 8 mm. ♂.

Antennæ brownish, palpi steel-blue, passing into a violet blue. Proboscis long, steel-blue. Head with a glistening white mark on the hinder border of the eyes and around the first joint of the antennæ. Thorax clear brown with greenish-gold scales (the available specimens are partly rubbed). On each pleura, above the coxæ, is a hairy, silver-white spot; scutellum with greenish-golden scales; abdomen a strong steel-blue, glistening white along the extreme edge; legs, steel-blue, the coxæ with silver-white scales, the femora with golden-yellow scales on the underside. The penultimate joint of the hind tarsus is silver-white scaled. Veins of the wings more clearly defined on the anterior than on the hinder border; halteres bright. Also recorded from the Island of St. Vincent, West Indies, by Williston, "Trans. Ent. Soc.," Lond., 1896, p. 271.

Habitat.—The island of Porto Rico.

12. **MEGARHINA AMBOINENSIS,** Doleschall.

Caudal adornment showing no contrasted colours. Tarsi with certain bands or joints whitish; thorax decorated with glittering golden hairs on a dark green ground.

Description from Doleschall, "Natuurkundig Tijdschr. voor Nederlandsch Indië," Deel XIV., p. 381, ♂.—Palpi, proboscis and abdomen blue, thorax glittering golden-green;

wings yellowish, legs blackish-blue with a ring on the first joint of the hind tarsi white.

Length 4½ lines (Dutch).

Head blackish green; the eyes as well as the antennæ, black; the latter, in the males, densely plumed up to the last joint. The palpi and the long awl-shaped, downward bent proboscis, steel-blue, the palpi white between the second and third joints, and a little hairy. The thorax dark green, decorated with glittering gold-coloured hairs, very much rounded off in front, and broadest where the wings are attached, in which situation are some long stiff hairs; the pleuræ white; the abdomen compressed, steel-blue, with long densely packed darker blue hairs on both sides of the three last segments, so as to give the outline of a fish's tail to this part of the insect. The wings are longer than the abdomen (projecting beyond it), yellowish with yellow-brown veins; the legs long and thin, almost hairless, blackish-blue, the uppermost joint of the hind tarsus white.

Habitat.—Amboina, during the dry season, in the bush; not uncommon.

13. **MEGARHINA TRICHOPYGUS** (Wied.).

Caudal tufts showing no contrasted colours. Tarsi with certain bands or joints whitish; thorax black with greenish-golden scales and the abdomen brown.

Culex trichopygus, Wied., "A. Z. I.," p. 4.

The date of the description is antecedent to the establishment of the genus *Megarhina*, but the large size of the insect, its brilliant metallic coloration, the broadening of the hinder abdominal segments by tufts of hairs, and the subulate terminal joint of the palpi making it pretty certain that the species belongs to this genus.

Description from Wied., "A. Z. I.," p. 4.—Thorax black with greenish-gold scales; abdomen fuscous, with steely scales, and with the ante-penultimate segment broader, and, as also those behind it, hirsute. 3½ to 4½ lines (German).

Antennæ brown; palpi yellowish, opalescing blue, with brassy scales below; the end joint subulate deep steel-blue; proboscis blue-black, tapering very much; head and thorax black with greenish gold and blue scales; pleuræ and coxæ brown, with silvery scales. Abdomen polished, brownish, with light steel-blue scales; belly with silvery and steel-blue scales; the ante-penultimate segment broader, fringed on either side; the penultimate and last segments progressively smaller, and also fringed with brownish black cilia, which show violet-blue in certain lights; legs yellowish-brown, with steel-blue, with silvery scales below. (The middle legs are wanting in the specimen described).

Habitat.—Brazil.

14. **MEGARHINA FEROX** (Wied.).

Caudal adornment showing no contrasted colours. Tarsi with certain bands or joints whitish; thorax chestnut brown; abdomen steel grey. Plate vi., fig. 9.

Culex ferox, Wied., "A. Z. I." p. 1.

Description from Wied., "A. Z. I." p. 1.—Thorax chestnut-brown; with the abdomen, legs, and palpi steel-grey; the alternate joints of the tarsi silvery; the belly gold colour. Length 5 lines (German). Antennæ fuscous; palpi steel-blue, passing into pale blue, with very pale golden scales below, and the joints glistening sapphire blue, with a subulate terminal joint, the remaining joints being very short for their length; proboscis steel-blue, very tapering. Head brown, with greenish-golden scales; pleuræ and coxæ light chestnut brown, with large silvery scales; abdomen steel-blue, the first segment being brighter: belly pale glistening gold colour, or of a dusky tint. Wings with yellow veins, but which are fringed with brown scales below; halteres metallic bronzy-yellow; legs steel-blue; femora with golden scales below; knees iridescent snow-white.

(The hind legs were wanting in the one available specimen).

Addendum.—In a male specimen in the collection of H. V. Wiethem, of Hamburg, the tarsi, especially of the

hind legs are much prolonged, and of a clear steel-blue colour, the fourth joint being white; the tarsi of the not elongated middle legs have the third and fourth joints white; the front legs are broken.

Note from Macq., "D. E.," suppl., II., p. 7.—R. Desvoidy and Wiedemann describe the second joint of the middle tarsi as silvery. We have observed a complete specimen, and find that the hinder tarsi have also the fourth and fifth tarsal joints silvery on the inner side; there is a little black at the tip of the fifth. In a ♀ which we have observed, the fore tarsi have the second and third joints silvery on the anterior side; the middle tarsi have these two joints entirely so; the hind ones have also the fourth and fifth joints silvery.

Habitat.—Brazil.

The specimens of this species in the British Museum have the anterior fork-cell exceptionally small, even for a *Megarhina*, and so narrow as to be scarcely distinguishable. The nape has a sapphire spot like that on the first abdominal segment, and these two patches catch the eye strongly in most lights. These specimens are from Georgia, North America.

In the British Museum collection there are three apparently undescribed species closely resembling *M. ferox*, but which are nevertheless, I believe, distinct.

The following notes may serve to facilitate the identification of further examples.

14*a*. **MEGARHINA** (?) (Sp. from Para, South America).

♀.—In size and general colouration closely resembles *M. ferox*, except that no banding can be made out on any of the remaining tarsal joints. It is, however, certainly quite distinct as it presents the exceptional peculiarity of having the venation of the wings formed on the plan of the genus *Culex;* the anterior fork-cell being rather longer but narrower than the posterior, their stems being equal. The proboscis is large and though not markedly curved looks like that of a *Megarhina*.

14*b*. **MEGARHINA** (Sp. from St. Domingo).

♂.—This species also presents a close general resemblance to *M. ferox*, but is probably distinct as the fourth tarsal joints of the hind legs are wholly white while the other legs appear to be quite unadorned. The palpi have sapphire bands on all the joints except the last. The wing is that of a typical *Megarhina*, but the anterior fork-cell is nevertheless markedly larger than in *M. ferox*.

14*c*. **MEGARHINA** (Sp. from Queensland).

Closely resembles *M. ferox*, but all the tarsal joints are basally white, banded, and the anterior fork-cell not so minute.

15. **MEGARHINA INORNATA** (Walker).

Caudal adornment showing no contrasted colours. Tarsi without white markings. Generally of a dark and sober colouration.

Description, from Walker, "Proc. Linn. Soc." VIII., p. 102. ♂ fuscous with the palpi purple with two silvery stripes; the antennæ black; the pectus and femora silvery; the abdomen livid, black towards the apex; wings fuscous grey. ♂ brown; palpi purple with two silvery bands, longer than the thorax; rostrum black, bent, nearly as long as the abdomen. Antennæ black; pectus silvery, cinereous; abdomen livid, black towards the tip, where it is furnished with diverging lateral black hairs; legs setulose, without bands; femora silvery, cinereous, except towards the tips; wings brownish, cinereous, veins brown. Length of the body 6 lines, of the wings 10 lines.

In the types in the British Museum the legs, as a matter of fact, are, at any rate in the female, conspicuously banded as the bases of the first and the whole of the second joint are silvery. In the male, however, I can distinguish no banding on any of the basal joints that remain intact.

Two unidentified specimens (♂ and ♀) of a *Megarhina*, from Natal, appear to differ in no way from Walker's types.

Habitat.—New Guinea.

PLATE VII.—Illustrating the Markings of the Wing in Certain Species of Anopheles.

Fig. 1.—Wing of *Anopheles costalis*, Loew, from West Africa.

Fig. 2.—Wing of *Anopheles Rossii*, Mihi, from Calcutta.

Fig. 3.—Wing of *Anopheles funestus*, *sp. n.*, from West Africa.

Fig. 4.—Wing of *Anopheles albimanus*, Wied., from Jamaica.

Fig. 5.—Wing of *Anopheles Lindesayii*, Mihi, *sp. n.*, Bakloh, Punjab.

Fig. 6.—Wing of *Anopheles vanus*, Walker, from type.

Fig. 7.—Wing of *Anopheles sp.* "*a*," from Calcutta.

Fig. 8.—Wing of *Anopheles sp.* "*b*," from Calcutta.

Fig. 9.—Wing of *Anopheles punctipennis*, Say, from the type of *C. hyemalis*, Fitch, in British Museum.

Fig. 10.—Wing of *Anopheles annulipes*, Walker, from the type in the British Museum.

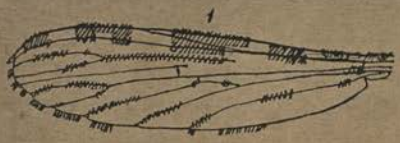
Fig. 11.—Wing of *Anopheles pictus*, Loew, after Ficalbi's figure of its supposed synonym *An. pseudopictus*, Grassi.

Fig. 12.—Wing of *Anopheles superpictus*, Grassi, after Ficalbi's figure.

Fig. 13.—Wing of *Anopheles claviger*, from a specimen of *An. maculipennis*, Hffmg. in British Museum.

Fig. 14.—Typical wing of *Anopheles* according to Skuse.

The first five figures were drawn with the camera lucida at about the same amplification. The others, however, are free-hand drawings and necessarily cannot claim the same accuracy, nor do they at all represent the proportional size of the wings. The dark-scaled portions are represented by oblique shading.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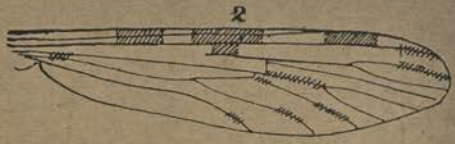
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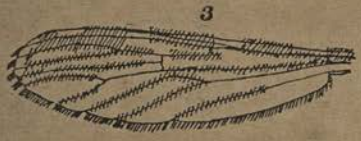
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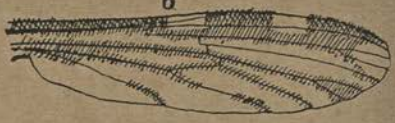
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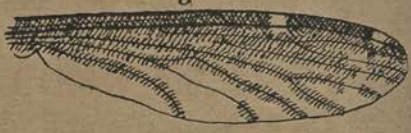
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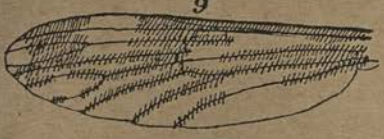
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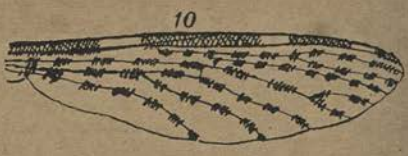
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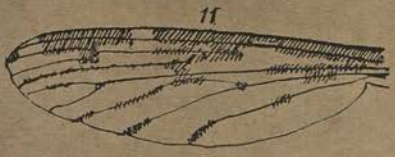
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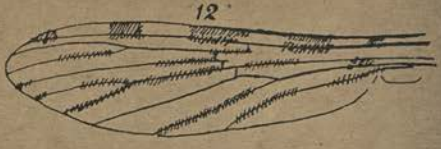
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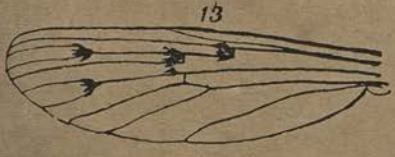
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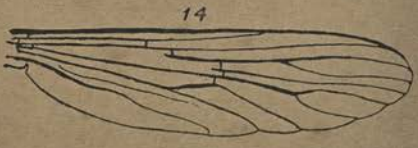
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Bale and Danielsson, Imp.

Genus II. **ANOPHELES,** Meigen (1818).

ALTHOUGH not containing anything like the number of species comprised in *Culex;* this is not only the second largest, the number of species enumerated in the present work being thirty, but from the medical point of view it is by far the most important genus of the family, for with the exception of some doubtful observations on *Culex nemorosus* and *C. pipiens,* the great weight of evidence tends to show that it is the members of this genus alone that are concerned in the transmission of the malarial parasite from man to man. If this prove to be actually the case, it is certainly a not only fortunate but very astonishing circumstance, for though the females of this genus attack man and animals, being less frequently house species, they do not inflict one tithe of the annoyance on the human race that is effected by its constant companion, the *Culex*, considered merely as biting insects.

However, it is probably the case that this genus alone acts as the intermediate host of the malarial parasite, and its comparative uncommonness goes far to explain how it is that, although malaria cannot be shown to originate in localities where gnats are unknown, it is not always most rife where they are commonest, and may be entirely absent in extremely infested districts. It does not follow that any and every member of the genus is capable of transmitting the disease, and it is quite possible that a limited number of species of this and other genera are alone able to do so, but for the present all its members must be regarded with suspicion.

It must, however, be remembered that, whatever be the case with regard to human malaria, the members of the genus *Culex* are certainly capable of becoming infected by closely allied protozoal parasites, as has been conclusively demonstrated in the case of *Culex fatigans*, Wied., by Major Ronald Ross, I.M.S., who traced in that species the intermediate stage of a blood parasite of sparrows

and other birds,—the *Proteosoma Labbé*, "Report," Calcutta Government Press, 1898.

The great distinguishing character of the genus is that the *palpi are about the length of the proboscis in both sexes.* It is true that this is also the case in *Megarhina*, but the *Anopheles* are grey insects, and generally have dappled wings, and show none of the brilliant colouring and metallic reflection of the other genus, and are for practical purposes, not likely to be confused with it by any one who has had the opportunity of inspecting a few species of both. In *Megarhina* none of the species have dappled wings. It may be asked how the genus is to be distinguished from *Culex*, if a male specimen be alone available, but there is no real difficulty as the spatulate form of the last joint of the male palpi distinguishes them easily alike from *Culex* and *Megarhina*.

In five of the known species the wings are without spots and though in the majority of these there is some tendency to accumulations of scales on certain portions of the veins these would certainly not be denominated as "dappled" by the ordinary observer. As already mentioned, the attitude of the resting insect is characteristic, the members of this genus posing themselves at an angle with the surface on which they rest, while the *Culices* hold themselves more or less parallel to it.

The following formal description of the genus is taken from Ficalbi's "Revisione delle specie Europei." The only essential characters of Meigen's genus are those of the palpi, and that the additional characters given by Ficalbi and others are merely interesting as representing the usual characteristics of the genus which are mostly correlated with them. For example, Skuse does not mention the point, noted by Arribálzaga, that the basal cells may be open externally owing to the absence of the transverse veins that bound them on that side.

Skuse, in his monograph on the Australian *Culicidæ*, gives a description of the wing which he considers characteristic of the genus; but an examination of some fourteen species leads me to the conclusion that it would be impossible to

draw up a description that would be in any way generic. Not only are the transverse veins wanting in several species, but in several cases the auxiliary and first longitudinal have a common stem and do not separate till the origin of the second longitudinal, all three commencing at one point as separate veins.

There is, however, one character which is more or less marked in all five of the species, in which I have been able to inspect specimens of both sexes, and that is, that both fork-cells appear to be uniformly smaller, and with longer stems in the male than in the female. In the female the anterior fork-cell is usually distinctly longer, though narrower, than the posterior, but in the male the anterior is seldom longer than the posterior, and is often of dimensions almost recalling those of the wing in *Megarhina*. Whether this is the case in other species I cannot, of course, say, but the point is worthy of further examination.

Anopheles (*Culex*, *L.*; Fabr., Schrank, Gmelin, Villiers, Meigen, 1804), from "F. R."

Characters of the family, with the following generic distinctions — Palpi about the length of the proboscis in both sexes. In the female the palpi are really four jointed, but there exists in the basal joint a constriction which makes them appear five jointed, and sometimes a further constriction which brings up the number of apparent joints to six. In the male the palpi are really three jointed, but a constriction near the base of the first joint similarly gives the appearance of four joints, and sometimes there are two further constrictions, one towards the middle of the long joint and one in the apparent basal joint, which gives the appearance of five or even six articulations; but the enumeration of four joints for the male and five for the female is that generally received. In the female the palpi are filamentous, and are kept when at rest parallel with the proboscis, forming with it a bundle of three pieces. When the female bites she raises and separates them; and in her the ante-penultimate joint is as long as, or a little longer than, the penultimate and last joints together.

In the male the last two joints of the palpi are short, thick, and olive-shaped. Nape with a crown of scales behind. Abdomen villous, but as regards the dorsal and ventral surfaces the villosity wants the scaly covering which is so abundant in the genus *Culex*. Legs very long, terminated by simple or denticulate claws. *Anopheles*, from Ἀνωφελής, noxious.

Table of the Species of the Genus ANOPHELES.

A. With the costal margin of the wings marked with interrupted darker and lighter colouring.

I. The dorsum of the abdomen decorated with lighter markings.

i. With the tarsi more or less decorated with lighter portions.

1. *An. albimanus*, Wied. Abd. segs. with triangular grey spots Last 2 tarsal joints wholly white.
2. *An. superpictus*, Grassi. Abd. segs. brownish yellow with darl brown hinder borders. Costa yellowish white with 4 com paratively small, completely separated blackish spots.

ii. With the tarsi not stated to be banded.

3. *An. barbirostris*, Wulp. Costa fuscous, with 2 snowy spots "Abdomen with pale incisions."

II. Abdomen not noticeably banded, but with a thin darker hind border to the segments, especially distinct when rubbed.

i. With the tarsi more or less decorated with lighter portions.

4. *An. pictus*, Loew. Abd., brassy yellow. Wings with 3 large and small sub-apical brown spots, the 2 basal united on the actual costa.
5. *An. Rossii*, Mihi. Much like *An. pictus* but with the wings lighter, the spots separate, and the large middle one prolonged inwards so as to form a flattened letter T.
6. *An. costalis*, Loew. Wings darker than either of the preceding, the costa being black at the very base, counting which, there are 5 separate black, with 4 narrow light intervals.

III. Abdomen not stated to be at all adorned.

i. With the tarsi more or less decorated with lighter portions.

7. *An. albitarsis*, Arribálzaga. Costa black with 3 grey spots. Last 3 tarsal joints wholly white.
8. *An. argyrotarsis*, Desv. Costa with fuscous spots, last joints of hind tarsi clay-coloured.
9. *An. musivus*, Skuse. Costa violet brown with 4 whitish spots. First 4 tarsal joints tipped whitish. Subcostal transverse vein at the middle of the auxiliary.
10. *An. Mastersi*. Like *musivus*, but with the subcostal transverse, well beyond the middle of the auxiliary vein.

11. *An. annulipes*, Walker. Costa black with 3 narrower light interruptions, the remaining veins minutely beaded with black and white spots. Femora and tibiæ minutely banded.
12. *An. vanus*, Walker. The wings elsewhere pale, are dark along the costa with 2 small snowy interruptions, both rather far out, and the apex also white.
13. *An. annularis*, Wulp. Closely resembles the above, but it is probable, from the context, that the costal spots are more numerous.
14. *An. sinensis*, Wied. The costa bright brown with 2 interruptions.
15. *An. sp.* "a," from Calcutta. Wings sooty, with 3 small white interruptions on the costa. Apices of palpi white.
16. *An. sp.* "b," from Calcutta. Wings intensely black with 2 yellow interruptions on the costa. Apices of palpi black.

The tarsi not stated to be banded.

17. *An. quadrimaculatus*, Say. Wings with a brown spot on the middle of the costa and another large and a small spot on the wing-field.
18. *An. funestus*, *sp. n.* Wings, very dark, with 5 dark patches on the costa, the 2 basal, connected by dark scales on the auxiliary vein; the whitish interruptions very narrow.
19. *An. punctipennis*, Say. Wings dark-scaled with the costa and other veins interrupted in the outer third by an ill-defined band; and an apical whitish spot. General coloration rufous.

B. With the costa uniformly coloured but with spots on the wing-field.

a. The wing spots produced by differently coloured scales.

ii. Abdomen and tarsi not stated to be banded.

20. *An. crucians*, Wied. With white spots here and there on the brown veins.
21. *An. Lindesaii*, Mihi, *sp. n.* Wings with a small apical whitish spot and the veins with grey and black scales.

b. The wing spots formed by accumulations of scales.

i. The abdomen and tarsi banded.

22. *An. claviger*, Fabr. With 4 wing spots over the junctions of veins.

ii. The abdomen not distinctly banded but with the hind border of the abd. segs. darker, the tarsi banded (presumably from the name).

23. *An. annulimanus*, Wulp. With 2 spots on the wing-field, formed by accumulations of scales.

iii. The abdomen and tarsi alike unadorned.

24. *An. atratipes*, Skuse. Costa black, but with 6 prominent patches of scales on the other veins.

C. Wings with an ill-defined brown spot in the stigmatic region. Abdomen and tarsi unadorned.

25. *An. stigmaticus*, Skuse. Scales and wing membrane alike darker in the stigmatic region.

D. Species in which the wings are unspotted.

I. The abdomen dorsally decorated with lighter bands or marks.

i. The tarsi with a band at the base of the first joint.

26. *An. bifurcatus*, *L.* Of medium size.

27. *An. nigripes*, Stæger. Smaller than the above, with the appendages darker.

28. *An. villosus*, R. Desvoidy. Larger than *An. bifurcatus*.

Probably all the three above Species are mere synonyms of An. claviger.

II. With the dorsum of the abdomen uniformly coloured.

i. With the tarsi white-ringed.

29. *An. annulipalpis*, Arribálzaga. Last tarsal joints wholly white.

ii. With the tarsal joints uniformly coloured.

30. *An. ferruginosus*, Wied. Stems of halteres pure white.

1. ANOPHELES ALBIMANUS (Wied.).

Wings with yellowish spots on the dusky brown costa, as well as others on the wing-field and along inner border. Tarsi with the apices white. Abdomen with large triangular grey spots. Plate vii., fig. 4.

Description from Wied., "A. Z. I.," p. 13.—Fuscous; the abdomen with large, triangular, grey spots; the wings with dusky spots; the apices of the tarsi snow-white. Length, $2\frac{2}{3}$ lines (German), ♀.

Apices of the joints of the palpi snow-white. Each segment of the abdomen with a grey, triangular spot, the apex of which is directed forwards. Costa of the wings dusky brown with yellowish intersections which lie lengthwise; there are spots also on the inner edge and middle part of the wings, but they are much smaller.

Noted as found in the island of Porto Rico by V. von Röder, in "Entomolog. Zeitung, Stetin," 1885, p. 338.

Major Ross has also recently received from Jamaica some specimens, undoubtedly of this species, which, though much rubbed, enable me to furnish the following additional details.

The general ground colour of the insect is sooty black, but remains of the scales forming the dorsal abdominal spots can still be made out, and there are also remains of linear grey markings on the thorax. In addition to the terminal white on the ♀ palpi there are minute white rings at the articulations of the next two joints; the rest of these appendages being sooty black with very long, shaggy tomentum near the base. The sooty proboscis has also a minute whitish tip. The anterior femora do not appear to be dilated at the base and have no bands, but there is a faint knee-spot. The apices of the tibiæ and of the first three tarsal joints show minute white rings in addition to the very characteristic pure white of the whole of the last two joints.

The costal margin of the wings is pale at the actual base, but soon shows short lengths of black; these are followed by a large dark spot occupying the greater part of the middle third of the fore part of the wing and, after a yellowish interval of some length, there is a second irregularly triangular spot not quite so large; the intervals between these are a golden brown, but the apex of the wing and some portions of the other long veins are white scaled, though the dark scaled parts greatly preponderate. The markings throughout are of a rather diffuse character and appear to vary somewhat in different individuals.

Habitat.—St. Domingo, Hayti.

2. **ANOPHELES SUPERPICTUS,** Grassi (1899).

Wings spotted; yellowish white with four comparatively small, completely separated, brownish-black spots on the anterior margin; a small apical dark spot and certain limited portions of the longitudinal veins with dark scales. Tarsal joints nearly black with white, mainly apical, bands. Thorax brown ornamented with white scales in the middle. Abdominal segments brownish-yellow with darker distal borders.

The following description from Ficalbi's "Venti Specie de Zanzare Italiane," Florence, 1899, is somewhat abbreviated.

Proboscis nearly black but whitish at the lip. Palpi of the female as long as the proboscis, nearly black with white rings at junction of second and fifth, third and fourth, as well as the entire terminal joint white. Nape black with a median white tuft. Thorax with the dorsum browner at the sides, ornamented towards the middle by white scales; pleuræ grey. Legs with the femora brownish, those of the first pair not proximally dilated. The remainder of the joints brownish-black with white rings at the tibio-tarsal, and tarsal articulations affecting mainly the apices of the proximal joints.

Wings, light coloured and generally clear, spotted with yellowish-white and brownish-black or black; the anterior margin black, completely interrupted by three light spots so that the black portion is divided into four parts, or elongated spots of not very unequal length; in addition to those an apical black spot and several of the longitudinal veins are black-scaled for various portions of their lengths, much as in *An. pseudopictus* but not so densely.

Abdomen very hairy but without scales on either its dorsal or ventral surface; the segments generally brownish-yellow with darker hinder borders. Ficalbi has only met with a female. Length including the proboscis 7-8 mm. Plate vii., fig. 12.

Habitat.—Italy.

3. **ANOPHELES BARBIROSTRIS,** Van der Wulp.

Wings with two white spots on the brown costa, both in outer third. Tarsi unbanded; legs brick-red; abdomen dark brown with pale incisions; thorax faintly striped.

Description from "Notes from the Leyden Museum," VI, p. 48.—Fuscous; thorax faintly striped; proboscis and palpi very hairy; legs brick-red; halteres fuscous; costa of the wings fuscous, with two snow-white spots. Length 5 mm. ♀.

The straight, projecting, hairy palpi give this species a peculiar aspect, differing from our indigenous species of the genus. Dark brown. Rostrum and palpi longer than the head

and thorax taken together, clothed with brown, scaly hairs; the joints of the palpi hardly distinguishable. Thorax rather long and narrow, somewhat lighter coloured than the head and abdomen, quadrangularly truncated in front, with indistinct longitudinal stripes on the upper part. Abdomen with pale incisions. Legs very long and slender, testaceous; femora a little enlarged towards the end, when viewed in some directions, whitish at the tip. Halteres piceous. Veins of the wings with brown scales which are accumulated towards the costa; a point of snow-white scales at two-thirds of the costa, and a similar point near the tip; the two furcate cells of equal length.

Habitat.—Mount Ardjoeno, East Java (Hekmeyer).

4. **ANOPHELES PICTUS**, Loew.

An. pseudopictus, Grassi, 1899. Wings spotted; three prominent yellow spots on the dark costa, and five to seven small dark ones on the wing field. Tarsi unbanded; abdomen unbanded, brown with yellow scales; thorax grey, with linear markings. Anterior femora slightly dilated at the base.

Description from Loew, "Dipt. Beiträge," 1845.—Wings spotted, anterior femora thickened at the base. Length of the body three lines. Rather pale brownish-grey; the thorax dorsally cinereous, with five longitudinal black lines, between which the greyish-white shows; in front of the scutellum which has the form of a tranverse line, and is brownish-yellow, is a boat-shaped mark which combines with the dark median line and reaches well out to the sides; the grey colour of the upper part of the thorax is limited at the sides by a brown longitudinal line. In the middle of the sides of the glabrous thorax are brownish-yellow marks, which show white in certain lights, and are especially brilliant on the anterior and middle coxæ. The head is ash-coloured, the margin of the eyes whitish and the frons has a tuft of dirty white hairs in front. The antennæ are brownish, with brownish hairs, which vary in colour from brownish to

black, according to the direction of the light. The first joint of the palpi is brown and very short; the second longer and densely covered with scales, especially at the base so that it appears thickened; its colour and that of the scales is brown, although the latter have a whitish lustre on the surface. The third joint is brown, longer than the second, slender at the very base, but thickened at the extremity, where it is furnished with a long tuft of iridescent brown hairs, the scales of which resemble hairs, and have a distinctly whitish lustre, especially on the second half on the internal and upper aspect, as also have the scales which clothe the second halves of both the last joints which are shorter, nearly equal in length, flattened, brown, fringed on its internal and upper part with brownish hairs, and the fourth joint with a tuft. The abdomen is flattened, brownish, with clear brownish hairs, shining white on the upper surface, with an obsolete median blackish stripe. The last segment is entirely brown. The wings are hyaline, the veins and margin covered partly with white and partly with black scales, those of the internal fringe form alternate patches of white and brown, On the anterior margin are three large brown spots; the first, which commences not far from the root of the wing, is connected with the second on the costa itself, although separated internally by a point of white; the second brown spot, at its outer end, sends out a bow-shaped band over the transverse veins, concavity backwards, and is separated from the third spot by a small snow-white area, which lies adjoining, and upon the costal margin itself. The third spot is separated by a similar area towards the tip of the wing. In addition to these spots the veins at the tip of the wing are clothed with brown scales, though the fringe is there whitish. The other longitudinal veins have patches of brown scales, one on the middle of the sixth being especially distinct, but they do not form visible spots. Legs; the tips of the tibia and of the three first tarsal joints show, in certain lights, a yellowish lustre which makes them look ringed; the fore coxæ are exceptional in that they taper towards the end instead of being of uniform width.

Grassi has recently ("Venti Specie de Zanzare") appar-

ently separated this species into two—*pseudopictus* and *superpictus*. The latter is clearly a new and distinct species, but it is difficult to make out any valid distinction between it and Loew's species, so I prefer to give it as a synonym, as the description of *An. pictus* appears to sufficiently cover all the characters given. Plate vii., fig. 11.

Habitat.—Southern Europe and coast of Asia Minor opposite Rhodes.

5. **ANOPHELES ROSSII**, *Mihi.*

Wings with four black spots on the white costa, and some of the other veins with alternate portions white-scaled and black-scaled, forming indistinct additional spots; tarsal joints pale grey with minute apical bands; abdomen indistinctly banded, the lighter basal portion of the segments greatly preponderating; thorax without longitudinal markings. Plate vii., fig. 2.

SIZE OF PARTS IN ♂ AND ♀ SPECIMENS.

Male.		*Female.*	
Head	0·5 mm.	Head	0·7 mm.
Thorax	1·2 mm.	Thorax	1·0 mm.
Abdomen	2·7 mm.	Abdomen	3·4 mm.
Proboscis	2·0 mm.	Proboscis	1·9 mm.
Palp	2·0 mm.	Palp	1·7 mm.
Antenna	1·8 mm.	Antenna	1·2 mm.
Wing	4·0 × 1·0 mm.	Wing	3·3 × 0·8 mm.

♂.—Head covered with a mixture of brown and whitish scales, the latter preponderating on the vertex, the nape nearly black; eyes black, with a narrow whitish margin; antennæ pale fulvous, with silky-brown verticils, the last joint rather darker at the tip, the basal entirely golden-brown; proboscis nearly black, golden-brown at the tip. The palpi are mainly whitish, with the extreme apex and the base for some little distance, and points on the joints dark brown; thorax of the same tint as the head, with a minute, blackish shoulder patch, and some indistinct darker markings laterally and on the coxæ; legs pale grey, the anterior

femora are perhaps somewhat thicker than those of the other legs, but cannot be said to be perceptibly dilated at the base. The tarsal joints have narrow apical white bands. Wings longer than the abdomen, hyaline, the veins with white scales except on the spots and dapplings; there are four distinct black costal spots, the largest of which is placed opposite the origin of the second longitudinal vein, close behind it is one of smaller size; at the tip of the wing is the smallest of the series, and the fourth is placed midway between this and the large spot first mentioned. The large spot in the middle of the costa is not oblong as in *An. costalis*, but consists of a long portion on the costa, and opposite the middle of this, on the auxiliary vein, a shorter portion, so that the entire spot forms a flattened letter T. Besides these spots, visible to the naked eye, many of the veins are black for small portions of their length, the most noticeable situations being the fourth longitudinal, which is black from its forking to the transverse veins; the tips of the fourth, fifth and sixth longitudinals; the root of the fifth longitudinal, and a minute spot on the costa at its base. The humeral transverse vein is curved and placed very close to the root of the wing, so that it is with difficulty made out; the subcostal transverse is placed a good deal beyond the middle of the auxiliary vein, and quite near the origin of the second longitudinal, the latter being placed much nearer to it than to the origin of the supernumerary transverse, auxiliary vein reaching the costa before the level of the tip of the hinder branch of the fifth longitudinal. Third longitudinal appearing at the junction of the supernumerary and middle transverse veins, which together form a continuous line joining the second and fourth longitudinals, and a little beyond the tip of the sixth longitudinal; all these cross-veins being of about equal length. Anterior fork cell slightly longer and narrower than the posterior, the base of the former slightly in advance of that of the latter; base of the anal cell a little beyond the level of the origin of the second longitudinal vein. Halteres with white stem and black club. The abdomen is pale yellowish, with pale golden hairs, distinctly paler than in *An. costalis;* venter pale brown,

except a pair of lateral white spots on the first four segments. In the rubbed state the hind border of the dorsum of the segments is very distinctly darker, but this barely shows through the tomentum in undenuded specimens.

♀.—Closely resembles the ♂. Her palpi are uniformly black except the apical half of the end joint, a band at its base and another on that of the penultimate, which are more or less golden-brown. The antennæ are black throughout, with scanty verticils of lighter tint, the basal joint golden-brown; the legs have the coxæ pale drab, the femora very pale at the base, darker at the distal end where there is an external black line which is continued on the tibia, with the interruption of a faint lighter knee spot; the hind legs show four lighter basal bands to the tarsal joints. The venter of the abdomen is pale drab with indistinct darker lateral lines, and a dark hinder border to the three or four distal segments.

The venation of the wings differs in the two sexes, the anterior fork-cell being smaller than the posterior which it barely equals in length, both cells being much shorter than in the female, in which the anterior though narrow is very distinctly the longer of the two cells.

This description, which has been drawn up from the better preserved specimens in the British Museum, replaces my description in the "Journal of Tropical Medicine," October, 1899, as the specimens then at my disposal were much rubbed, so that some of the markings had disappeared.

Habitat.—Taken in Calcutta by Major Ronald Ross, I.M.S. He did not, however, succeed in cultivating in it the parasite of human malaria.

6. **ANOPHELES COSTALIS,** Loew.

Wings with the costa interrupted by patches of darker and lighter colouration, but not generally dark; the costa has the basal third dark with two minute interruptions, followed by three other dark spots, the first of which is the largest, separated by smaller yellowish interruptions; por-

tions of the other veins are black-scaled, but the lighter tinted scales preponderate. Abdomen not distinctly banded, but with the hind border of the segments rather darker, especially in the male. Tarsi with minute rings mainly apical, but involving also the base of the next joint.

Description from Loew, "Berlin. entomol. Zeitschr.," 1866, p. 55. ♀.—Pale tinted, with the palpi black with white rings: wings with uniformly black costal spots. Length of the body, 2 lines, of the wings, $2\frac{1}{12}$ to $2\frac{1}{6}$ lines. Clay-coloured; the two first joints of the antennæ yellow, remaining joints brownish; palpi black, with a white ring on each of their joints. Thorax with a bright brownish, longitudinal stripe on either side, and a distinct brownish line in the middle; pleuræ striped and speckled with pale brown; the hairs on the thorax, scutellum, and abdomen entirely light yellowish; legs yellowish brown; the femora yellowish at the base; all the outermost points of the knees and tibiæ of a yellowish coloration. Wings limpid, with pale yellowish, almost white-haired veins, with here and there, patches of black hairs, so as to produce a characteristic marking of the wing. Of these spots, the most striking are four placed on the anterior border of the wing, and not extending beyond the first longitudinal vein; and forming elongated black spots, which alternate with clearer portions of the wing-border; the spots on the remaining area of the wing are not so distinct, because, owing to the veins being placed further apart, they nowhere approach each other sufficiently closely to admit of their black portions combining to form a noticeable spot.

In the examples collected by the Liverpool Malaria Expedition on the West Coast, with the exception of the wings, the insect is a rather dark brownish grey rather than clay coloured. The palpi of the ♀ have the apex broadly white, and there are in addition, two narrow white bands on the articulations, further their scaly covering is rougher than in *An. funestus*. The legs are dark brown, somewhat speckled with yellowish, especially beneath, but show nothing of the nature of a band, except on the tarsi. In the fore legs, these have the first three joints with apical bands, which involve somewhat the contiguous bases of

the next joints: in the middle legs the first three, and in the hind, the first four joints have purely apical, narrow yellowish bands. The wings are lighter than in *An. funestus*, but have a larger proportion of dark scales than in *An. Rossii*, Mihi, or, to judge from Ficalbi's figures, than Grassi's *pseudopictus* and *superpictus*. The ♂ has the terminal joint of the palpi with a dense tuft of hairs, which are brownish yellow internally and blackish externally; the only other ornament being a very minute ring on the articulation between the second and third joints.

Mr. Austen further makes the following note: — Although this species much resembles *An. pictus*, Loew (described from two females from the coast of Asia Minor, opposite the island of Rhodes), in having the front femora thickened towards the base, I think it is undoubtedly distinct. In the first place, it is much smaller (only $2\frac{1}{4}$ instead of 3 German lines). Then the two last joints of the palpi have an adornment of yellowish-white scales instead of being brown; and the wings have four dark blotches on the costal margin in place of three, and all are separate, whereas, in Loew's species, the first and second patches are joined together on the costa itself. Lastly, the legs differ, the tarsi being banded in *costalis*.

Habitat.—Caffraria, South Africa.

7. **ANOPHELES ALBITARSIS,** Arribálzaga.

Wing spotted; the costa black with three grey spots; there is also an apical black spot, and the veins are clothed with alternate lengths of grey and black scales. The last three tarsal joints of the hind legs wholly white, and the first two dusky, sometimes with apical white rings; in the other legs, only the apical joint is wholly white, and the tips of the other joints; abdomen grey with fuscous hairs; thorax grey with linear markings.

Description from "L. A.," p. 36. ♂ and ♀. — Head cinereous with grizzly hairs; eyes black with narrow silvery margins; proboscis black, whitish or grey at the

apex; palpi black or dusky, with black scales among which some grey ones are sprinkled; with three white rings at the apex, which are always distinct but vary in size. Antennæ black or dusky, with grey hairs in the ♀; or cinereous with dusky verticils in the ♂. Thorax dorsally grey with three fuscous lines which vary in distinctness; pleuræ blackish or dusky testaceous, lightly clothed with frosty grey, mixed with a few silvery scales. Wings hyaline, but densely clothed with fuscous scales, which are thickest, and nearly black on the costa, where however, the dark coloration is interrupted by three large grey spots; there is a minute black spot near the apex of the wing, and the remaining veins are clothed with alternate lengths of grey and black scales, so as to appear banded. Anterior and middle legs dusky or blackish, tending to yellowish in certain lights, the femora and tibiæ with more or less scanty white or whitish scales; the tibiæ white at the apex; the first four tarsal joints white at the apex and the last wholly white; the hinder femora and tibiæ like those of the other legs, but only the first two joints of the tarsi are banded, that on the first joint being often indistinguishable; while all the last three joints are wholly white. Abdomen blackish, opaque, frosty cinereous, with scanty dusky villosity; length 5 to 5·50 mm. There is an immature variety in which the legs and pleuræ are testaceous, and the white spots wanting.

The bites of this species are not particularly irritating, nor is it very blood-thirsty. It is not often found in houses.

Habitat.—Buenos Ayres, and parts of the Argentine litoral.

8. **ANOPHELES ARGYROTARSIS,** Desvoidy.

Wings with the veins spotted and fuscous spots on the costa; tarsi dusky, the apices of those of the hind legs clay-white; abdomen unadorned, black.

Description from Desv., "Essai," p. 411. Proboscis black; body blackish; abdomen unspotted; legs thin, pale fuscous, the hinder tarsi clay-white at the apex.

♀.—Proboscis black; palpi fuscous; thorax and abdomen black or blackish, the abdomen without marks; legs long and slender, pale brown, the last joint of the hind tarsi clay-white; wings with villous spotted veins, the costa with fuscous spots. Length, 2½ lines.

Habitat.—Brazil.

9. **ANOPHELES MUSIVUS,** Skuse.

Wings spotted, tinged brown in the stigmatic region, with the costa violet-brown with four whitish spots; tarsal joints, the first four tipped whitish; femora and tibiæ with small patches of whitish scales.

Description from "S. A. C"., p. 1754. ♀.—Length of antennæ 2·02 mm.; expanse of wings 5·08 × 1·27 mm.; size of body 5·84 × 1·01 mm. Antennæ brown, with a white pubescence as well as verticils; second, of scapus and first three or four flagellar joints with white scales, about four-fifths the length of the palpi, first joint of scapus ochre-brown; head brown with some white scales on the vertex, from which stretch out over the front, some long white hairs; proboscis brown, equal to the palpi. Palpi violet black-scaled, second joint with a slight apical, white-scaled ring; last three joints with a broad white apical ring, and the second and third with a longitudinal white patch above; in the second about the middle, and in the third on the first third of its length. Thorax tawny with a slaty reflection, sparsely white-scaled, beset behind and laterally with yellow hairs; pleuræ tawny; scutellum fuscous, ochreous at the sides, densely fringed with long yellow hairs; metanotum fuscous. Halteres, stem yellow; club fuscous. Abdomen rather more than twice the length of the thorax, fuscous, levigate, yellow-haired, the last segment with some yellow scales; lamellæ fuscous. Legs violet black-scaled, the femora and tibiæ, and sometimes the metatarsi, with small patches of whitish scales, the tibiæ and first four tarsal joints slightly tipped whitish. Coxæ ochre-grey, sprinkled with white scales and yellow

hairs. In the hind legs the metatarsus slightly longer than the tibiæ. Wings the length of the thorax and abdomen combined; hyaline tinged brown in the stigmatic region, the veins densely scaled with alternate patches of violet-brown and whitish, four long very dark patches occurring on the costal vein; subcostal transverse placed at the middle of the auxiliary vein. Auxiliary reaching the costa before tip of hinder branch of fifth longitudinal; second longitudinal starts a little before the marginal transverse; third appearing to commence in the fifth basal cell, a little before the supernumerary transverse and almost opposite the tip of sixth longitudinal; middle, half its length in advance of the supernumerary transverse; posterior transverse opposite tip of sixth longitudinal, and placed half its length before the middle transverse; all three cross veins of about equal length; first sub-marginal considerably longer and somewhat narrower than the second posterior cell, its base a little before that of the latter; base of anal cell slightly before the origin of the second longitudinal vein.

Habitat.—Elizabeth Bay, near Sydney; Mount Kembla, Illawara, N.S.W. February.

10. **ANOPHELES MASTERSI,** Skuse.

In all respects like *An. musivus*, but smaller, but with the subcostal transverse vein placed considerably beyond the middle of the auxiliary vein, instead of in the middle, as in that species.

Description from "S. A. C.," p. 1,757.—Length of antennæ ♂, 1·89 mm.; ♀, 1·54 mm. Expanse of wings, ♂, 3·55 × 0·76 mm.; ♀ 3·81 × 0·76 mm. Size of body, ♂, 4·31 × 0·62 mm.; ♀, 3·30 × 0·62 mm.

Very like *A. musivus*, but smaller. Antennæ in the ♂, about $\frac{3}{4}$ the length of the palpi, very pale ochreous, with silky verticils; first joint light red-brown; in the ♀, about $\frac{4}{5}$ the length of the palpi, dark brown, with the pubescence and verticils white, and the first two or three flagellar joints

white-scaled. Head brown, with white scales on the vertex, from which long white hairs project over the front. Proboscis about the length of the palpi; in the ♂, entirely brown, in the ♀, with the basal half dark brown, and the apical half pale ochreous. Palpi brown, the second joint just white tipped, and the last three with a broad white apical band, nearly covering them in the last two; in the ♂, the second and third joints have a short white streak above. Thorax, ♂, fuscous; ♀, ochre-brown; imperfectly clothed with whitish scales and yellow hairs; pleuræ, metanotum, and scutellum fuscous, the last, dull ochreous laterally, thickly fringed with long yellow hairs. Halteres, club fuscous, stem yellow. Abdomen in the ♂, more than twice the length of the thorax, shorter in the ♀; fuscous, levigate, densely golden-haired (longer in the ♂); last segment and ♂ forceps white-scaled. Legs violet-black-scaled, the femora, tibiæ and metatarsus with numerous whitish spots, and the tibiæ and first four tarsal joints slightly tipped with the same. In the hind legs, the metatarsus a little longer than the tibiæ. Wings about the length of the abdomen in the ♂, longer than the whole body in the ♀, hyaline, tinged with very pale brownish yellow in the stigmatic region, the veins densely clothed with alternate series of violet-brown and whitish scales, four long very dark violet patches on the costa. Subcostal transverse, placed considerably beyond the middle of the auxiliary vein; the latter reaching the costa considerably before the tip of the hinder branch of the fifth longitudinal; third longitudinal appearing to begin a little before the supernumerary transverse, opposite the posterior, and somewhat before the tip of the sixth longitudinal; these three cross-veins about equal in length, indistinct in some specimens; middle transverse placed half its length in advance of the supernumerary transverse; posterior placed its entire length before the middle transverse, first submarginal cell considerably longer, and somewhat narrower than the second posterior cell, its base placed somewhat before that of the latter; base of anal cell placed opposite the origin of the second longitudinal.

Habitat.—Blue Mountains, N.S.W. (Masters).

11. **ANOPHELES ANNULIPES,** Walker.

Wings spotted, greyish, the costa black with four oblong whitish spots. Tarsal joints with apical white bands. The femora and tibiæ with numerous whitish bands.

Description from Walker, "Insecta Saundersiana," Vol. I. Dipt., 1850, p. 433.—Brown, very slender, with hoary tomentum. Proboscis partly testaceous, rather longer than the palpi. Palpi whitish with brown bands, longer than the antennæ. Thorax indistinctly striped. Legs very long and slender; femora and tibiæ with numerous whitish bands; femora testaceous towards the base; tarsi with a white band; hind tarsi extremely long. Wings slightly greyish; veins brown, with whitish bands, thickly ciliated; costa blackish, with three oblong whitish spots. Halteres whitish. Length of body 3-3½ lines; of the wings 6-7 lines.

The type in the British Museum has four broad interruptions along the black costa, and as there are corresponding white spaces on the auxiliary, and first and second longitudinal veins, these spots have a considerable width, as well as length and they are considerably longer than the pale interruptions. The actual root of the wing is pale. There are smaller interruptions on some of the other veins, but they are too small to catch the eye and give rise to brindling rather than to dappling. The hinder tibiæ are markedly shorter than the first tarsal joints and the former, as well as the femora are fuscous, marbled whitish so as to impart a minutely banded appearance to them. The tarsal joints all have minute apical white bands. In the wings, the first submarginal cell is much longer and narrower than the second posterior. Plate vii., fig. 10.

Habitat.—Tasmania.

12. **ANOPHELES VANUS,** Walker.

Wings spotted, cinereous, with black points along the costa. Tarsi testaceous with white basal rings on the joints, general coloration brown.

Description from Walker, "Journ. Proc. Linn. Soc.," IV. (1860), p. 91.—Male. Cinereous brown, slender. Proboscis full half the length of the body. Antennæ broadly plumose. Legs testaceous, long, very slender; joints of the tarsi white at the base. Wings slightly cinereous, with black points on the fore part; veins black, fringed. Length of the body 2½ lines; of the wings 4 lines.

The type in the British Museum shows this to be a pale slender species, with long thin legs. The wings though generally rather pale, are dark along the costal margin, with two small snowy interruptions, one just before the middle and the other at the junction of the middle and apical thirds, and with an apical white spot; the rest of the scales are grey with a few scattered white scales in the internal fringe. The specimen is too denuded to form any idea of the original decoration, if any, but there is, at any rate, no remaining trace of banding of either the abdomen or tarsi. The palpi (♂) retain their tomentum, and are strongly tufted, without any bands, being uniformly dark brown and considerably longer than the proboscis. Plate vii., fig. 6.

Habitat.—Makessar, in the Celebes.

13. **ANOPHELES ANNULARIS,** Van der Wulp.

Wings spotted, the costa black with white spots, the veins with fuscous and white scales; tarsi banded white, position of bands not stated; legs brick-red; abdomen unbanded, (?) black; thorax adorned with linear marks.

Description from Van der Wulp, "Notes the Leyden Museum," VI., p. 249. ♂. Fuscous; the thorax striped; the proboscis naked and black; the palpi brownish, white banded; legs brick-red; the tarsi banded white; costa of the wings spotted white. Length 4·5 mm. ♀. Blackish; thorax with a dark bluish dust, and five longitudinal, fuscous lines; pleura light grey, with black spots arranged in longitudinal rows. Antennæ with light brown hairs; rostrum black; palpi fuscous, as long as the rostrum; the base of the first and second joints and the whole

of the apical joint white; the two first joints covered with a dense, short, dark pilosity. Legs long and slender, testaceous; anterior tarsi with a white ring on each joint; the long hind tarsi fuscous in the middle, and with a white ring, wholly white towards the end. Veins of the wings with fuscous and white scales; the costa alternately spotted with dark brown and white.

This species may be perhaps identical with *A. sinensis* Wied, "A.Z.I.," p. 547, according to Van der Wulp but the tabulation shows it to much more closely resemble *An. vanus* (Walker), with which it is possibly identical.

Habitat.—Mount Ardjoeno, East Java (*fide* Hekmeyer).

14. **ANOPHELEIS SINENSIS,** Wied.

Wings spotted, the costa being bright brown with two interruptions; there being also brown puncta on the wing-field; abdomen undescribed, unbanded; thorax with linear adornment.

Description from Wied. "A.Z.I.," p. 547. Brownish, with the costa and puncta on the wings brown; the legs with whitish joints. Length, $2\frac{3}{4}$ lines (German), ♂ ♀. Antennæ and palpi brown; the latter, in the females, appears thicker than the proboscis; thorax with a linear stripe in the middle and with deeper brown stripes on the sides; wings, with bright brown scales along the costa with two, as it appears, constant interruptions; on the mid-field of the wing are several brown points or spots.

Habitat.—China.

15. **ANOPHELES** sp. "a," from Calcutta.

♀.—Wings very dark, but with three small white interruptions on the costa; abdomen uniformly black. The last two hind tarsal joints white, the rest black, saving a

minute ring on articulation between the second and third joints; apex of palpi white. Plate vii., fig. 7.

Besides *An. Rossii*, Mihi, two other species were separated by Mr. Austen from those brought from Calcutta, by Major Ronald Ross. The above is that which he speaks of as his "small dapple-wing." On account of its sooty blackness, it might well be named *fuliginosus*.

With the exception of a few extremely narrow white marks on the wings and appendages, it is of a sooty black throughout. The antennæ are black with whitish verticils; the proboscis black a little whitish at the tip; the palpi black with about half the terminal joint white, and very minute white rings at the joints; thorax (denuded) black, appears to have had some white tomentum when fresh. Legs black, with small white bands near the apex of the femora, and at the apex and base of the tibiæ, except those of the hind legs which appear to have only apical tibial dots; there are also some whitish marks on the coxæ; the fore legs have minute apical rings to all the joints, except the last, which are entirely black, while the hind tarsi are as above described. The wings are intensely black, relieved only by three very narrow interruptions on the costa, a few small white spots on some of the longitudinal veins, and minute white interruptions of the internal fringe at the points of junction of the longitudinal veins with the margin; abdomen entirely black. Distinctly smaller than *An. Rossii*, Mihi.

16. **ANOPHELES** sp. "b," from Calcutta.

♀.—Wings intensely black, except two very small yellow interruptions on the costa, the outer one of which is subapical, and a few white dots on the longitudinal veins; abdomen entirely black; tarsi with apical whitish rings to some of the joints; apex of palpi black. Plate vii., fig. 8.

The above is all that can be stated with certainty of the third of the species from Calcutta, separated by Mr. Austen, as the specimens are not sufficiently well preserved for final

description. It differs from the preceding in the apex of the palpi being entirely black and in the light portions of the costa being yellow instead of white. The few remaining tarsal joints have apical yellowish bands. As it is, if anything darker than *sp. a*, it might very well be named *nigerrimus*. It is distinctly the largest of the three species brought by Major Ross from Calcutta.

17. **ANOPHELES QUADRIMACULATUS,** Say.

Wings with a large brown spot on the costa, and another large and two smaller spots on the wing-field. Tarsi unbanded, (?) dark brown; abdomen unbanded, pale tinted, with brownish hairs; thorax grey, with linear markings.

Description from Weid., "A. Z. I.," p. 356.—Thorax cinereous, with fuscous lateral spots; the wings with four fuscous spots Length 3½ lines (German) ♀.

Thos. Say:—"Long's Exped. to St. Peter's River," II., Appen., p. 356. Palpi brown; thorax ash-grey, with two brown lines. They run together, when seen from in front, and when seen obliquely from in front are very distinct with a very clear brown stripe on either side; abdomen whitish, with brownish hairs; wings limpid, the veins fringed with brown scales. In the middle of the costa of the wings, a large brown scaly spot, and, further from the apex, in the middle of the wing, another, equally large; and there are two smaller spots, at the bifurcation of the veins extending to the apex; legs deep brown; the extreme apex of the femur and tibia yellowish.

Habitat.—The north-western part of Pennsylvania.

18. **ANOPHELES FUNESTUS,** sp. n.

Wings with the costa marked by interrupted darker and lighter coloration, the dark portions preponderating; on the actual costa there are five interruptions, the two basal being

connected by dark scales on the auxiliary vein; there are also white areas over the transverse veins, the stem of the posterior fork-cell and the bases of the fifth and sixth longitudinal veins. Abdomen unbanded, black. Tarsi uniformly black.

Description from Giles's "Report of Liverpool Malaria Expedition," Addendum I.:—

♀.—General coloration black, with but little adornment. Head black with a crest of scattered white scales; eyes with a minute white margin; proboscis black, a little paler at the apex. Antennæ black with scanty whitish verticils; palpi black, very smooth, with the apex and two narrow bands on the articulations white. Thorax black, clothed with white scales over the greater part of the dorsum; legs black, the only relief being a scarcely perceptible paler knee-ring; Wings ornamented as above described; the anterior fork-cell long, parallel-sided, with a short stem; the posterior much shorter, wider, and wedge-shaped, with a longer stem; supernumerary and middle transverse veins of fair length, in one line, the posterior shorter and more than twice its length internal to it; the scales of the internal fringe with minute white interruptions opposite to the junctions of the longitudinal veins with the margin. Halteres with the knob black and the stem rather lighter; abdomen black, glabrous, with very scattered white hairs.

In the ♂ there is no obvious banding of the palpi, but the apex of the last joint is grey, followed by a narrow black ring, and then by an even narrower pale ring; the rest of the appendage being of the same funereal tint as the rest of the body. The antennæ are black with dense black verticils; which, however, show a certain paler lustre in certain lights; the abdomen is black; the wings, though they resemble those of the ♀ closely in ornamentation, differ somewhat in venation, the anterior fork-cell being twice as long as the posterior, and its stem much the shorter, though both stems are rather long, while the posterior is very short and but little wider than the anterior. Length, excluding the proboscis, 2·6 mm. *Vide* plate vii., fig. 3, and plate viii.

Habitat.—Free Town, West Coast of Africa. This species is undoubtedly concerned in the transmission of malaria. For further details *vide* "Report of Liverpool Malaria Expedition."

19. **ANOPHELES PUNCTIPENNIS** (Say).

Culex punctipennis, Say. *Culex hyemalis*, Fitch. Wings with a single broad interruption on the costa in the outer third which extends across the greater part of the width of the wing as a rather ill-defined band, and an apical whitish spot, the rest of the wing being rather darkly tinted; abdomen unadorned (?); tarsi uniformly coloured (?).

Although this species was regarded by Wiedemann as a synonym of his *An. crucians*, Howard and Marlatt, from the examination of a large amount of material, state that the two species are undoubtedly distinct, though they do not specify the points of difference. On the other hand, they regard *C. hyemalis*, Fitch, as a synonym of this species. ("Household Insects of the U. S.," p. 22, 1896). The figure of the wing was drawn from a specimen of Fitch's species in the British Museum.

Description from "Journ. Acad. Nat. Sci.," Philadelphia, III. (1823), and "Insec. N. Amer.," vol. II., p. 39 (1869):—*C. punctipennis*, body dark rufous, covered with cinereo-ferruginous hair; feet elongated; wings maculated. Orbits, bright cinereous eyes deep black. Antennæ and proboscis deep fuscous or blackish, immaculate; thorax dark rufous, with obsolete blackish lines, and covered with cinereo-ferruginous hair; wings hairy, dusky, with a hardly perceptible pale band beyond the middle, and obsolete dusky spots; scutel glabrous, dark rufous, with a longitudinal bluish vitta; halteres yellow at base; feet elongate, deep fuscous or blackish; pectus each side, above the posterior feet, plumbeous.

It is probable this is the species which Fabr. considers as the same with the *pulicaris* of Europe; it is common on the Mississippi and troublesome to travellers. When the

insect is at rest, the wings being incumbent, one on the other, the pale band is very distinct; when recent the eyes are greenish-blue. I observed this species in considerable numbers on the eastern shore of Maryland. The dusky spots on the wings of this species are occasioned by the thicker growth of hair in those parts.

[Belongs to *Anopheles;* Wiedemann has changed the name to *A. crucians.*—Osten-Sacken.] Plate vii., fig. 9.

Habitat.—United States.

20. **ANOPHELES CRUCIANS,** Wied.

Wings with white spots here and there on the brown veins, uniform along the costa; tarsi unbanded, dusky brown; abdomen uniformly brown with grey hairs; thorax red-brown with linear markings.

Description from Wied., "A. Z. I.," p. 12.—Tawny; the thorax with three deeper tinted lines; the abdomen covered with grey hairs; the wings with dusky spots, and costa. Length 2½ lines (German).

Thos. Say:—"Journ. Acad. Nat. Sci.," Philadel. 1822, 9, 1; *C. punctipennis.*—Antennæ brown; palpi brownish black, the joints at its root nearly white. Thorax reddish-brown, with three dusky brown lines, the middle one of which is much the most delicate, the spaces between them whitish, in certain lights; the hinder part of the back with dusky brown stripes. Abdomen uniformly brown, with grey hairs. Wings uniform along the costa, elsewhere brown scaled, with white spots, and white here and there on the veins. When at rest, unless the wings lie apart, one sees beyond the middle a pale band, this can also be made out in the single wing, but is not so clear; halteres yellowish, with brown knobs; legs brownish-yellow, with dusky-brown tarsi.

Habitat.—Pennsylvania, New Orleans. Very common on the Mississippi, where it is very troublesome to travellers.

21. **ANOPHELES LINDESAII**, sp. n.

Wing not distinctly spotted, but with the costa and some of the anterior veins black scaled, giving a diffused darker appearance to this portion of the wing, the rest of its scales being grey, with the exception of a small whitish spot at the apex of the wing; tarsi without bands. Thorax black with a large well defined patch, forming the greater part of the dorsum, grey, saving a very fine black median line. Abdomen nearly black, the hinder border of the segments darkest. Plate vii., fig. 5.

Head black, with a patch of whitish tomentum on the vertex, which extends forwards between the bases of the antennæ so as to give the appearance of a rostrum; eyes black; proboscis, palpi, and antennæ uniformly dark brown. Thorax with a large quadrangular patch covered with whitish scales, covering the greater part of the dorsum, on which is a very fine median black line, in front the patch has a rather ferruginous tint; pleuræ black with a few white scaled spots in front. Legs generally brown, darker on the tarsi, which do not appear to be banded; the hind femora whitish, with a broad black band at its apex, and a smaller one about its mid-length, the other femora, black and white scaled, the former preponderating at their tips, the anterior femora slightly thickened near the base. Wings not distinctly spotted, but with the costa, the greater part of the length of the second and fourth longitudinal veins and their forks, as well as the tips of the branches of the fifth longitudinal, with dense black scales, the remaining scales being grey. Auxiliary vein joining the costa just beyond the middle transverse vein; second and third longitudinals with distinct scaly extensions running back into the first basal cell; supernumerary and middle transverse veins forming a single line; posterior transverse a little longer and placed a little internal to them, the latter opposite a point nearer the base than the apex of the hinder branch of the fifth longitudinal; first sub-marginal cell longer and narrower than the second

posterior, its base distinctly nearer the base of the wing. Length of the body 4·50 mm.; of the wing 3·30 mm.

Habitat.—Sent me by Captain Victor Lindesay, I.M.S., from Bakloh, in the Punjab. In many respects it resembles *An. Rossii*, Mihi, but the wing is quite different, and it is generally much darker, so that it is very possibly the darker species which Major Ross, I.M.S., originally found to convey human malaria, but of which he was unable to obtain a further supply of specimens.

22. **ANOPHELES CLAVIGER** (Fabricius).

Wings with four spots on the wing-field, the costa being uniformly dark, except at the apex, where its colour fades to form a fairly distinct spot; tarsi unbanded, but with an apical yellowish spot to the first joints; abdominal segments brown with yellowish basal markings; anterior femora not thickened at the base. Plate v., fig. 9, and plate vii., fig. 13.

Description from "F. R.," p. 228.—*C. bifurcatus*, Meigen, 1804; *C. claviger*, Fabr., 1805; *An. maculipennis*, Meigen, 1818; *An. grisescens*, Stephens, 1828. Wings with four spots, formed by accumulations of scales. Anterior femora not thickened at the base, resembles *An. bifurcatus*, but has a generally yellower coloration, and the latter has no wing-spots; proboscis dark brown, with a faint yellowish ring at the point of attachment of the terminal labelli in the ♂; palpi of the ♂ just shorter than the proboscis; last joint clubbed; brownish-black throughout, except on the last joint, which has numerous, rather long pale hairs, especially internally. Palpi of the ♀ just shorter than the proboscis, very dark brown, with the penultimate about twice the length of the last joint, and the antepenultimate a little longer than the last two joints together; plumes of the ♂ antennæ brownish with yellowish reflections, its extremity darker. Antennæ of ♀ dark brown, with brownish-yellow reflections, and a faint whitish ring at the origin of the verticil of the scapus; eyes rather dark metallic green, with a border of clearer tinted down. Nape brown, with a straw-

coloured patch of bristly scales in the middle line, which extends also over the head, to end in an acuminate tuft between the roots of the antennæ, and is broadened immediately in front of the nape, and narrows as it passes forwards; the nape is also provided with a crown of scales exactly resembling that of *An. bifurcatus*, its yellowish portion forming a continuation of the patch on the nape and head. Thorax clothed with rather short brazen hairs, those on the posterior and lateral margins of the dorsum being longer and stiffer, in the middle of the dorsum of the thorax is a brownish leaden-grey area, which shows in front some traces of a continuation of the whitish nucal spot, while behind, a minute chocolate-coloured line may be nearly always distinguished, and the area is limited laterally by distinct reddish-brown lines, thickest in the middle, and extending the entire length of the thorax; the pleuræ are of the same colour but lighter than the bands; halteres brownish-black, with brownish-yellow stems. Wings generally brown, rather yellowish, especially in the ♂, with four black spots, brightest in the ♀, and placed at the first anterior bifurcation on the transverse vein, which joins the bases of the stems of the two forks with the vena interposita, and at each of the two forks. The border of the wing is adorned with brownish-black scales, which fade off at the apex to a tawny tint, so as to form a fairly distinct spot; stem of the anterior fork a little shorter than that of the hinder, the branches of the anterior fork longer than its stem, and also than those of the hinder fork; anterior branch of the hinder fork nearly equal to its stem, and longer than the hinder branch; coxæ glabrous yellowish; the rest of the leg joints are generally yellowish brown, varying in some individuals to even black, though those of the type are dark brown. Femora nearly black, rather lighter below; in all three pairs the apex of the femora, with the base of the tibiæ show a faint straw-coloured mark, so as to form a sort of knee-spot, only indistinctly present in the type; the tibiæ and first tarsal joints have similar yellowish apical marks; the abdomen is hairy, especially laterally, the hairs being clear yellow, and more developed in the ♂. On the

dorsal surface of the ♂, the segments, when denuded, are dark brown in the middle, and along the whole hinder border, but are clear yellow in front, the brown portion forming a triangle with the base behind, giving the appearance of alternate dark and yellow bands. In the ♂ the segments denuded of scales are dark brown for their hinder thirds, and this tint extends a little along their lateral margins, the rest of each segment being clear yellow; on the ventral surface, the segments denuded of scales are in the ♂, generally dark brown behind, and clear yellow in front; while in the ♀ they are of a very yellowish grey, tending somewhat to brown on the hinder border; this browning is more distinct on the two hinder segments, and the last may even appear totally brown. From this it appears that the whole abdomen has more brown in the ♂ than in the ♀. Length, including the proboscis, in the ♂, 7½-9 mm.; in the ♀ 7½-10 mm. The ♂ is always slimmer than the ♀.

Mr. Theobald, I understand, looks upon this species as a synonym of *An. bifurcatus L.*, an opinion with which I am personally inclined to agree. I have seen a specimen in the Jardin des Plantes labelled as *bifurcatus*, in which the absence of any spots was by no means pronounced, and I believe the only difference is one of age, in old or rubbed specimens the wing spots losing their distinctness.

Habitat, &c. — Widely diffused throughout Europe; Zetterstedt records it from Scandinavia, Stephens and Walker from England, Schiner from Austria, Meigen and others from Germany, Gimmerthal from Russia, and Ficalbi finds it common in Italy, in fact, from the extreme north to the Mediterranean Islands. It is very common throughout Italy, but especially in small houses, near water, more so than the other species of the genus. The larva lives at the surface of clear water, and will not tolerate dirty water, such as is often preferred by species of the genus *Culex*. It generally subsists upon the juices of plants, but the female does not disdain to suck the blood of man and mammals. It is often very troublesome to domestic animals

in stables, and is more persistent in its attacks on man than the ordinary Mosquito, producing great irritation of the skin.

Grassi's recent researches indicate this as the species most concerned in the communication of human malaria in Italy.

23. **ANOPHELES ANNULIMANUS,** Van der Wulp.

Wings with the costa uniformly coloured but with two spots on the wing-field formed by accumulations of scales; abdomen grey-brown, with darker hinder borders to the segments; tarsi banded (?).

Description from "Tijdschr. voor Ent.," 1867, p. 129.—♂.—Head dark brown; occiput with dense, black hairs. Antennæ whitish, with brown rings, the verticils light brown with yellow reflections; proboscis dark brown, one and a-half times as long as the head and thorax, with lighter brown reflections above and at the tip; palpi brown, the two first joints deeper coloured, the second joint a little longer than the first, together as long as the antennæ; the two last joints each as long as the second, brownish-yellow, together forming a flattened elipse, sparingly beset with long hairs. Thorax, scutellum dark brown behind; with fine yellow hairs on the shoulders; near the root of the wings, a small light grey border which is somewhat bowed out in the middle on either side; pleuræ mostly clothed with light-grey tomentum; abdomen proportionately short, grey-brown, the hinder borders of the segments dark brown, which is more obvious on the venter, where the ground colour is lighter; claspers shorter than the last abdominal segment, with long curved points; abdominal tomentum moderately dense, blonde-coloured. Legs dark brown, the coxæ and root of the femora brownish-yellow, apex of the latter rather dark, so that the pale yellow or whitish knee spots show out the more distinctly. Close to the base of the mid-femora is a whitish ring, bounded on both sides by a deeper brown than that of the ground colour; the fore tibiæ, except the basal

third, whitish with three darker brown rings, the last just before the tip, which is neither white nor yellowish; the white colour appears also at the tips of the other tibiæ; the hind legs are long and slender, especially the tarsi, the first joint of which is a fourth longer than the tibia; halteres dark brown, the stem and base lighter than the knob. Wings longer than the abdomen, with a slightly greyish tint; veins and scales brown; in the middle of the fore part of the wing, under the costa, on the second longitudinal vein, is a spot, and a little further out, above the small transverse vein; a second spot, both formed by accumulations of scales; the upper basal cell is always longer than the lower.

Habitat.—North America.

24. **ANOPHELES ATRATIPES,** Skuse.

Wings with six prominent patches of scales, not on the costa (which is black) but on the veins; tarsi black, without bands; abdomen black with golden hairs, but not banded.

Description from "S. A. C.," p. 1,755.—♀.—Length of antennæ 1·77 mm.; expanse of wings 4·18 × 0·84 mm.; size of body 4·18 × 0·76 mm.

Antennæ about three-fourths the length of the palpi, darkest brown, with hoary pubescence and verticils, first joint black; head fuliginous with white scales intermixed with some black hairs, and a tuft of long white hairs extending from vertex over the bases of the antennæ; proboscis and palpi uniformly densely violet-black scaled, terminal joint of palpi slightly white-tipped. Thorax pruinose brown, with a small roundish dark spot laterally about the midde of its length and another immediately in front of the scutellum; traversed by three longitudinal, parallel double lines of rather long black hairs, mixed with short, slender glistening white scales; lateral margins slightly testaceous with a few white scales and some short white hairs above and in front of the origin of the wings;

pleuræ dark brown, somewhat marbled with testaceous; scutellum testaceous with a dark roundish spot near the apex fringed with long black hairs; metanotum brown; halteres nearly black, the stem ochreous. Abdomen about twice the length of the thorax, black, levigate, sparsely golden-haired; lamellæ black fringed with short golden hairs; coxæ ochreous; legs violet-black scaled, femora and tibiæ bright ochre below and slightly at the tips. Wings the length of the entire body, bright ochre at the base, hyaline, very densely scaled, those on the auxiliary, first longitudinal and costa black, those on the remaining veins with black and yellowish scales arranged in alternate series, almost entirely black on the sixth longitudinal; there are six prominent patches of black scales placed as below:—On the fifth longitudinal, mid-way between its origin and its bifurcation, at the base of its fork, at the bases of the second and third longitudinals, and at the bases of the forks of the second and fourth. Costal ciliæ for a little more than the distance between the tips of the first and third longitudinals whitish, rest of the cilia violet-black with a light, silky reflection. Auxiliary reaching the costa opposite the middle transverse; second longitudinal beginning some distance before the marginal transverse; supernumerary and middle transverse opposite each other, placed half the length of the posterior transverse, beyond it; the last placed opposite the beginning of the third longitudinal and considerably beyond the tip of the sixth; first submarginal longer, but not narrower than the second posterior cell, its base placed a little before that of the latter; base of anal cell lying a little before the origin of second longitudinal.

Habitat.—Berowra, N.S.W. January.

25. **ANOPHELES STIGMATICUS,** Skuse.

Wings unspotted, though a little darker in the stigmatic region; tarsi without bands, violet-brown scaled; halteres yellow with brown knobs; abdomen unadorned, dark brown with golden hairs; thorax red-brown.

Description from "S. A. C.," p. 1,759.—Length of antennæ ♂ 2·02 mm.; ♀ 1·77 mm.; expanse of wings ♂ 4·06 × 0·88 mm.; ♀ 4·06 × 0·88 mm.; size of body ♂ 4·56 × 0·76 mm.; ♀ 4·06 × 0·76 mm.

Antennæ in the ♂ about five-sixths the length of the palpi, ochre-brown; first joint nearly black; in the ♀ about four-fifths the length of the palpi dark brown with whitish pubescence and verticils brown; scapus, except distal half of second joint, red-brown; head ochre brown, with golden hairs; proboscis scarcely longer than the palpi brown, almost black in the ♀, as also are the palpi. Thorax red-brown, darker in the ♀, with three double streaks of pale golden hairs, and laterally rather densely fringed with the same; pleuræ, ♂, red brown, ♀, fuscous; scutellum, ♂, ochreous, ♀, testaceous fringed with long golden hairs; metanotum, ♂, testaceous, ♀, very deep fuscous. Halteres, club-brown, stem yellow; abdomen in the ♂ twice the length of the thorax, shorter in the ♀, dark brown, levigate, golden-haired; ♂ forceps testaceous, densely haired. Legs violet-brown scaled, the femora pale yellow for four-fifths of their length in the hind legs, but beneath only in the other legs; coxæ warm brown; in the hind legs the metatarsus one-seventh longer than the tibia. Wings in the ♀ the length of the entire body; in the ♂ shorter by the length of the head; hyaline tinged brownish in the stigmatic region, where the veins, elsewhere light-brown scaled, are also darker. Subcostal transverse placed about the middle of the auxiliary vein, which latter reaches the costa opposite the middle transverse and considerably before the tip of the hinder branch of the fifth longitudinal; second longitudinal appearing to start in the first basal cell opposite the base of the anal cell and some distance before the base of the marginal transverse; third longitudinal apparently starting a little before the supernumerary transverse and before the tip of the sixth longitudinal; middle transverse in the ♂ placed opposite or somewhat before the posterior; in the ♀ its length beyond the latter, which is opposite the supernumerary; all about the same length; first sub-marginal considerably longer and narrower than the second posterior

cell, the tips of the fork slightly convergent, its base opposite that of second posterior cell.

This species is possibly a synonym of *An. ferruginosus*, Wied.; at least, there is nothing in the descriptions to distinguish them unless that the halteres in the present species are said to be yellow instead of white.

Habitat.—Blue Mountains, N.S.W. (Masters).

26. **ANOPHELES BIFURCATUS** (L.).

Wings unspotted; tarsi black throughout, with the exception of a very faint ring on the base of the first joint; abdominal segments brown with lighter basal bands; thorax grey with linear markings.

Description from "F. R.," p. 225. *C. bifurcatus*, L., 1758; *C. trifurcatus*, Fabr., 1792-1794; *C. claviger*, Meig.; 1804; *A. plumbeus*, Stephens ex Haliday, 1828. Head with a yellowish patch formed of bristly scales, which, starting from the nape where it is somewhat enlarged, narrows as it passes forwards between the eyes, and ends between the roots of the antennæ as a small acuminate tuft; the nape brown, with a median dorsal line, and provided rather behind with a crown of erect, bristly scales, yellowish in the middle to match the cephalic patch, and black at the sides; proboscis black or nearly so. Palpi of the ♀ similarly tinted, just surpassing the proboscis in length by their apices; last joint half the length of the penultimate which is slightly shorter than the antepenultimate, the last being slightly shorter than the last two joints combined. Palpi of the ♂ distinctly shorter than the proboscis, which surpasses them by the length of its terminal dilatation, nearly black, sparsely haired but scaly; the last joint clubbed and but little shorter than the penultimate. Antennæ of the ♀ brownish-black, with slight brownish-yellow reflections, and indistinct whitish rings at the roots of the verticils; basal joint rotund; of the ♂ with its plumes brownish-black, with a rotund first joint; the whitish scapus shews a black ring; the eyes are metallic green with a somewhite lighter border of downy hair.

Thorax grey, rather villous dorsally, with a double median straw-coloured line, and chocolate-coloured laterally, the brown colour forming two rather glabrous, dorsal bands, distinct in the middle and fading off at the ends; pleuræ clear grey; halteres black with yellowish stems. Wings brown (lighter in the ♂), unspotted, the veins and margin black-scaled; stem of the anterior fork rather shorter than the hinder, its branches alike longer than its own stem or those of the hinder fork; anterior branch of the hinder fork longer than the hinder, and nearly equal to its stem; coxæ yellowish, glabrous; femora nearly black throughout, yellowish at the extreme base; tibiæ black; there is an almost imperceptible yellowish knee; tarsi black throughout, with the exception of a faint basal ring to the first joint. Abdomen sparsely clothed with light yellow hairs throughout; the dorsal surface dark brown, with the anterior thirds of the segments a clearer tint in the ♀; while in the ♂ the lighter tint is disposed as a triangle, with its base behind on the distal border of each segment. Ventrally the segments in both sexes are hairy, but devoid of scales, and are dark leaden grey with a faint median brown line. Length with proboscis (♂), 7½-8½ mm., (♀), 8-10 mm.

The ♀ attacks human beings.

I have seen a specimen of Meigen's in the Jardin des Plantes, and believe that the only difference between this and *An. claviger* is that the description of the latter applies to young, fresh specimens, while that of the present species corresponds to females that have hybernated, and to rubbed specimens generally. In the above-mentioned specimen the wing marks are not as plain as in a fresh specimen, but they are quite distinguishable. If this be the case, the name *claviger*, being more modern, cannot stand.

Habitat.—Widely diffused through Europe, from Lapland (Zetterstedt) to Italy and the Mediterranean islands.

27. **ANOPHELES NIGRIPES,** Stæger (1839).

In all respects like *An. bifurcatus*, but smaller, not exceeding 8 mm., and with the proboscis, palpi, antennæ, tibiæ, and tarsi blacker, and the thorax cinereous.

Description from "F. R.," p. 227.—Proboscis, palpi, antennæ, and nape black; from the last starts a patch of bristly white scales, which passes forwards to end in a white tuft between the roots of the antennæ; behind, on the nape, there is a crown of bristly black scales sloped backwards. On the thorax, dorsally, are scattered cinereous scales, as well as two faint median longitudinal lines of clear-tinted down, and a brown lateral streak on either side; the pleuræ are grey; the halteres are black, with whitish bases; the wings are hyaline, with black-scaled veins, which cause the anterior margin to assume a darker tint; the legs have the coxæ dirty yellow, the femora black except at the extreme base, where they are yellowish, and the tibiæ and tarsi black; the abdomen is brownish-black, and its bristly hairs brazen yellow. Total length, including the proboscis, 7½-8 mm. The male is unknown.

Observation.—Probably this is also merely a variety of *A. bifurcatus.*

Habitat.—Mostly from Northern Europe, and said to be rare.

28. **ANOPHELES VILLOSUS,** Desvoidy (1827).

In all respects like *An. bifurcatus,* but larger and more villous. Length, 3 lines.

I merely place this species on the list because it is accepted with some reserve by Ficalbi. It can hardly amount to more than a variety of *An. bifurcatus.*

Habitat.—Paris.

29. **ANOPHELES ANNULIPALPIS,** Arribálzaga.

Wings unspotted, the costal vein and cell densely black-scaled, the remaining veins brindled black and gold; tarsal joints white-ringed, the last joints wholly white; abdomen dusky, with yellowish hairs; thorax fawn-coloured, with linear markings.

Description from "L. A.," p. 36.—Fuscous; the thorax

with chestnut scales, and three indistinct lines, the palpi dusky, densely plumed in the ♂, or black with silvery rings in the ♀ ; the legs and tarsi dusky black with white rings ; the tibiæ with silvery spots (♂), or the legs black with silvery rings (♀); head cinereous, with white hairs towards the frons. Antennæ black with dusky hairs (♀) ; or fuscous with dense verticils (♂) ; palpi black, straight, with silvery rings (♀), or dusky and densely villous, dilated and divergent at the end (♂); proboscis dusky black, with the apex white ; eyes with white margins. Thorax dark fawn above with three dusky lines ; scutellum dusky; metanotum dusky red ; pleuræ dull testaceous; coxæ yellow ; femora black, pale yellow internally and silver-banded externally; tibiæ black with white bands (♀), or dusky with numerous silvery dots (♂) ; tarsi nearly black, with silvery rings and the last joint wholly white. Wings hyaline, the costal vein and cell black-scaled, the other veins with alternate black and gold scales, so that they look confusedly banded ; abdomen dusky with yellowish hairs. Length 7 mm.

Habitat.—The banks of the Parana in Argentina. A rare species.

30. ANOPHELES FERRUGINOSUS, Wied.

An. quinquefasciatus. Say.

Wings unspotted ; tarsi unbanded, nearly black ; abdomen unbanded, dusky brown with yellow hairs ; thorax deep red-brown with linear markings. Stems of halteres with brown knobs.

Description from "A.Z.I.," p. 12.—Ferruginous ; the abdomen fuscous; the wings spotless. Length $2\frac{1}{2}$ lines (German) ♀.

Antennæ and palpi brown, the latter more dusky with a little white at the joints ; thorax intense red brown, but only in certain lights, if seen from behind whitish, and it then exhibits linear stripes, but looking backwards without stripes ; abdomen dusky brown with yellowish hairs ; veins of the wings with brown scales ; halteres intense

white with brown knobs; legs shorter than in *An. crucians*, brownish-black with yellowish femora.

Say. "Journ. Acad. Nat. Sci." Philadel. III., 10, 2
C. quinquefasciatus.

Habitat.—New Orleans.

Genus III. **PSOROPHORA**, Rob. Desvoidy (1827).

THIS Genus is usually included within *Culex*, Desvoidy's genus not having generally received acceptation. It has been revived, however, by Arribálzaga, in his monograph on the Argentine *Culicidæ*, and after inspecting the type in the Jardin des Plantes, I am also inclined to think that its peculiarities deserve generic value.

The great distinctive peculiarity is the presence on the shoulders (of the prothorax) of a pair of appendages, which serve to protect the stigmata of that segment (*vide* fig. 17, Plate VI.) from Desvoidy's "Essai." These are, I believe, present in no other members of the family, except *Megarhina*, and as such are surely of generic value. ANOTHER striking, though not quite exceptional character, is the great length of the male palpi.

Description from "L.A.," p. 38, and from Desv. "Essai."—*Psorophora*, Desv. "Essai," p. 412. Latreille in Cuv., "Règ. An.," p. 440 (1829). Habit entirely as in *Culex*, but with evidently distinctive generic characters. Antennæ short in both sexes (Desv.) but with the two terminal joints of the ♂, elongated. Prothorax with appendages on either side; mesothorax gibbous, with a distinct triangular depression on either side (Desv.). Palpi of the male almost twice as long as the proboscis when extended, with the last two joints curved upwards; the first two joints minute, the third linear nearly as long as the proboscis and parallel with it, a little swollen at the apex, moderately plumose; the last two joints somewhat stouter and together nearly equal to the third; the last somewhat rounded at the tip and thicker than the preceding; of the ♀ about a third the

length of the proboscis; the first joint very small, second and third obconical, the latter twice the length of the former; the fourth the longest, and the fifth rudimentary. Wings (*vide* fig. 12, Plate VI.), with the first sub-marginal no longer or scarcely as long as the second posterior cell. Legs with the tips of the femora, the tibiæ, and the tarsi, especially the hinder, densely ciliate. Claws of all the feet (figs. 13 and 14, Plate VI.) in the ♀ with a short sharp additional tooth so as to almost appear bifid; in the ♂ with the claws of the hind legs equal and single toothed; and those of the fore and hinder feet, with the outer claw more than twice as long as the inner, the latter being single-toothed and the former with two teeth; abdomen of the ♀ oblong, narrowed towards the tip; of the ♂ narrow, depressed, of nearly uniform width, with long sparse woolly hairs on either side. (Arribálzaga).

PSOROPHORA CILIATA, Fabr.

Wings unspotted; tarsi with basal white bands; thorax with yellowish scales and dusky marks and white pleuræ; abdomen with a median ferruginous stripe; prothoracic lobes large and prominent; general coloration brownish testaceous or yellowish; variable.

If included in the genus *Culex* the tabulation would bring this species between Nos. 30 and 31.

Description from "L. A.," p. 40.—*C. ciliatus*, Fabr., "E. S.," p. 401 and "S. A.," p. 35; Wied., "D. E.," pp. 36 and 39, and "A. Z. I.," 1, 3, 5; Walker, list 1, p. 2; Macquart, "D. E.," Sup. IV., p. 11; Osten-Sacken, "Catal. N. Amer. Dipt.," 18. *C. molestus*, Wied., "D. E.," 7, p. 4. *C. conterrens*, Walker, "Insecta Saunders.," p. 427.

Fuscous or yellowish red, densely clothed with whitish or yellowish scales; the legs testaceous, densely clothed with long black scales; the tarsi white-ringed. Head fuscous or testaceous, with close light yellow scales, and fuscous hairs, nude and dull in front, behind with a dull black median longitudinal line; eyes coppery green (during life). Antennæ

more or less fuscous, sometimes testaceous, with the base paler and yellowish; the basal joint testaceous; proboscis testaceous, darker at the tip, densely black and white scaled palpi brick-red, darker at the tip; those of the ♀ with dense black scales and hairs. Thorax with whitish or yellowish scales above and fuscous hairs, with two median fuscous lines, narrow parallel and prolonged forwards, and a patch on either side, broad towards the back and narrowed in front, as well as some lateral spots; scutellum with whitish yellow scales; pleuræ with dense greyish or whitish yellow scales; legs pale testaceous; the femora sparsely and the tibiæ and tarsi densely black fringed; the first and sometimes the second tarsal joints pale testaceous, the rest yellowish-white at the base and black at their apices. Wings slightly yellow with dusky scales; abdomen in the ♀ with dense yellowish scales and a few dusky hairs above and below in the ♂ darker, with dense woolly hairs on either side. Length 7-9 mm.

The type in the Jardin des Plantes is so rubbed that little of the coloration can be made out.

Habitat.—Carolina (Fabr.); Georgia (Wied., Mcqt. Walker); Atlantic Coast (Ost.-Sack.); Honduras (Walker); Argentina (Arribálzaga).

Van der Wulp in his list of Asiatic *Diptera* makes *C. molestus*, Wied., an Asiatic species, but I cannot trace his authority for this statement. Wied. gives only Georgia.

2. **PSOROPHORA HOLMBERGII**, Arribálzaga (1891).

Wings unspotted; tarsi with basal white bands; thorax with cinereous scales and three intense black marks, a broad median longitudinal, and a pair of lateral patches, narrowing off in front; abdomen black, with grey scales above and below.

Like the preceding, if placed in *Culex*, it would come between species 30 and 31

Description from "L. A.," p. 42.—Of about the same size as the preceding, but differs in the very black marking and

in the head having no line behind, as well as the mesonotum being grey with three black marks; head black, dark reddish or pitchy in front; behind and below with dense ash-grey scales; longer hairs than the preceding, and no line behind. Eyes black; palpi piceous with black scales; thorax deepest black, densely clothed with cinereous scales above, and adorned with three deep black marks; a broad median longitudinal and a pair of lateral patches, cut off in front, and extended back on each side of the scutellum; pleuræ frosty-cinereous; coxæ pitchy black. Legs testaceous, but with the femora paler, almost yellow; their apices and also the tibiæ densely clothed with black scales and hairs; anterior tarsi dusky black, indistinctly white-ringed; middle tarsi with the bases of the first and second joints almost silvery at the base; of the hind legs black with the first four joints basally white-banded, and the last joint entirely black; abdomen black, with grey scales above and below. Length 7-8 mm.

Habitat.—Chaco, in the province of Formosa, Argentina.

3. **PSOROPHORA BOSCII,** Desvoidy.

Description from Desv., "Essai," p. 413.—Pale yellow, the legs rather dusky yellow; the wings with villous veins. Length 2½ lines.

Closely resembles *Ps. ciliata*, but is generally pale yellow. Thorax with the dorsum rather dusky; the abdomen less so; legs rather dusky yellow.

Habitat.—Carolina; troublesome and common; spoken of as "the Mosquito" by the natives.

UNDESCRIBED SPECIES.

Note on undescribed species in the British Museum collection.

In all probability *C. mucidus*, Karsh., and *C. laniger*, Wied., belong to this genus. In the British Museum

collection there are also two closely allied species presenting a most exceptional appearance for gnats, as the casual observer would certainly take them for dung flies.

One of these species is represented by two specimens, one (much rubbed) from Natal, the other from Wyndale, on the west coast of Africa. They look much like the common yellowish dung flies (*Scatophaga*). The wings and all parts of the body are elaborately banded and spotted with intermixed fulvous, brown-black, and white scales; the legs being shaggy, the tufts of scales giving a dentate appearance to their sides. The anterior and middle tibiæ have the basal half black and the apical white, while the hinder are wholly brown; the second and third tarsal joints being white at the base and yellow at the apex.

The other species is from the Severn River, Australia, and is even more like a dung fly in general appearance. It might well be named *Scatophagoides*. It differs from the African species in having no part covered entirely with black scales, the darker portions being formed of a mixture of yellow and black scales. There is one white band on the femora, two on the tibiæ, and all the tarsal joints appear to be basally white. As in the other species, the internal marginal fringe of the wing is composed of alternate lengths of blackish and snowy-white scales, the dark patches being the longer.

There are also some specimens in the Museum sent by the late Lieutenant Watson, from Myingan, in Burmah, which appear, on a merely casual examination, to differ in no way from the Australian specimens, except that they appear darker owing to the presence of a larger proportion of black scales in the mixture forming the darker parts. A closer examination might, of course, bring out other differences.

These species have not as yet been described, but the above note may be of service in leading to the discovery of similar specimens.

Genus IV. **SABETHES,** Rob. Desvoidy.

THIS Genus was instituted by Desvoidy for the reception of a peculiar species of gnat, *C. longipes*. They are dark-coloured insects with brilliant metallic lustre, and in many respects resemble the Genus *Megarhina*. Desvoidy's definition merely states that the palpi are short and the middle tarsi and tibiæ dilated and densely ciliate, but this description would not cover the three following species, as in one the hind and not the middle legs are fringed.

Moreover, in *Sabethes scintilans*, Walker, which, however, is clearly closely allied to *S. longipes*, the male palpi are very long. In both sexes the antennæ appear to be exceptionally densely plumed, so much so that it is easy to mistake the female of *S. longipes* for a male.

Arribálzaga has suggested that *C. remipes*, Wied., is the male of *C. longipes*, Fabr., but it seems more probable that they are really distinct. In *Sabethes scintilans* all the legs are densely ciliate, though none form a paddle-shaped fan as is seen in *S. remipes*. These insects probably inhabit the depths of tropical forests, and this may be the reason why so few specimens have come to hand. It is obvious that the group requires further investigation and that the generic definition must be re-set, but in spite of this the group is so peculiar that it seems preferable to keep them apart from *Culex*.

The descriptions of the three species are as follows:—

1. **SABETHES LONGIPES** (Fabr.).

Wied., "A.Z.I.," p. 7. Black with coppery reflections; with the hinder tarsi and abdomen hairy. From South America.

Fabr. "Syst. Antl." 34, 2. *Culex longipes*; black with a coppery lustre, with elongated legs; the hinder tibiæ ciliate. A little larger than *C. pipiens*; haustellum outstretched, with its apex a little thickened. Antennæ strongly pectinate; thorax and abdomen black with a slight coppery

lustre; wings dark; legs long, with compressed, ciliate tibiæ and the tarsi whitish at their apices.

The type of this species is in the Royal Museum at Copenhagen, where there is only the remnant of a specimen without head or abdomen, and the thorax is stuck on so thick a pin that little more can be made out from this. Its colour appears reddish-brown with a steely reflex; pleuræ yellowish; veins of the wings with brown scales; legs violet, tibiæ yellowish, the fourth and fifth joints of the front tarsi yellowish, the hinder almost snow-white; all the tibiæ barely ciliate, the hinder tarsi, on the other hand, quite shaggy.

Note from the Appendix to the above work p. 546. There is a good male specimen of this species in the Frankfort Museum, which has the antennæ brownish; palpi brownish-black, tapering, porrect; proboscis a little longer, its apex of a silky lustre; abdomen black on top, with a slight steely lustre, passing into a coppery tint; belly yellowish silvery-white.

Length 3 lines (German).

Note from Macquart, "Dipt. Exot.," I., p. 34 (1838). Synonymous with *Sabethes loculipes*, Desvoidy. This species is ill-described. According to Fabricius its hind, instead of the middle legs, are ciliate; Wiedemann gives the posterior tarsi; Desvoidy the tibiæ and tarsi of the middle pair; Fabricius and Wiedemann both described males, the one figured is a female; the tarsi have not white tips as described by Fabricius, and the bases of the femora and of the fourth and fifth tarsal joints are not yellowish. Moreover, that of the hinder is not snow-white, as described by Wiedemann; the wings are very narrow and do not exceed the abdomen in length.

Habitat.—Guiana. Brought by M. Leprieur.

Further note by Macquart, *l.c.* "Suppl.," I., p. 8, records a ♂ specimen, and notes that, in this species the internal extends a little beyond the external basal cell.

2. **SABETHES REMIPES** (Wied.).

From Wied. "A. Z. I.," p. 573. Steel-blue, with the middle tibia and tarsus, the former at the apex and the latter at the base, thickly fringed.

Length, 2½ lines (German), ♂.

Antennæ brownish, proboscis and head steel-blue, with silvery scales below. Thorax and abdomen steel-blue, which, especially in the latter shades off into a greenish tint. The pleuræ appear greenish gold; belly yellowish with a silvery lustre, as also are the lateral edges of the base of abdomen. Coxæ silver scaled; legs a beautiful steel-blue, in the middle leg, the larger lower half of the tibia and the whole first joint of the tarsus is thickly fringed with long hairs, so as to form a sort of oar with a flat surface and an egg-shaped outline (somewhat as in *Lygæus bilineatus*, only in that species the oar is formed by a plate instead of by fringing hairs). The front and hind legs are entirely without fringes.

Note by Dr. J. R. Schiner, "Reise der Novara, Diptera," p. 31. The Expedition obtained one male from Brazil, which agrees closely with Wiedemann's description, only the legs are not steel-blue, but a clear violet; and the veins of the wings, particularly those near the anterior edge, re thickly fringed with brownish-black scales.

Habitat.—Brazil.

3. **SABETHES SCINTILLANS** (Walker).

Wings unspotted; tarsi unbanded; thorax black with a large silvery spot on each pleura; abdomen black unbanded.

Description from Walker, "List," p. 2. Walker, *l. c.* ♂.—Body black, hairy, with iridescent silvery reflections. Antennæ about half the length of the body, dull white, adorned with whorls of long, dark reddish-brown hairs, and clothed towards their tips with short down; palpi nearly as long as the body, brown, the two last joints black and hairy; a large white spot on each side of the chest;

proboscis as long as the antennæ. Legs very thickly clothed with hairs excepting the fore-legs and the shanks and feet of the middle legs, where the hairs are shorter and thinner. Wings slightly tinged with brown. Halteres dull red with black knobs. Length of the body 3 lines; of the wings 6 lines.

A very dark tinted species with brilliant metallic reflections, but with nowhere any signs of banding. The plumes of the antennæ (the type is a male) are exceptionally dense; the palpi about twice the length of the proboscis. In the wing the stems of the fork-cells are of equal length, the posterior cell being broad but a little shorter than the anterior, their bases opposite; all three transverse veins are nearly in one (oblique) line.

Habitat.—Para.

Genus V. **CULEX**, L.

Culex is the type Genus of the family, and comprises by far the largest number of species, about three-fourths of the entire number being included in it, the total number of species described in the present work being over 240.

As a rule they are soberly coloured, but on minute examination with a lens are often found to be elaborately and beautifully marked. In by far the greater number the wings show no definite spots, though they are often "brindled," owing to the veins being fringed with alternate darker and lighter scales, or owing to the scales themselves being parti-coloured. A certain number, however, exhibit distinct wing-spots, formed by accumulations of scales, and in a few of these the spots are at least as bril iant and distinct as in the most typical members of the Genus *Anopheles*, so that it is a mistake to imagine that the presence of wing-spots is conclusive of a Mosquito belonging to that Genus. The palpi are long in the males and short in the females, but differ a good deal in the details of their structure in the different species. Generally, those of the

males are about the length of the proboscis, and are rarely shorter, but they often greatly exceed it and may even be twice as long. In any case, the terminal joint is, with the single exception of *C. spathipalpis*, Rond, never broadened out into a spatulate form, as in *Anopheles*, which is a useful point to remember in distinguishing between the members of the two Genera, when no female specimen is available. The proportional lengths of the component joints vary a good deal, but, as a rule, the fourth or occasionally the third joint is the longest. In the female in most cases the last joint of the palpi is much the largest, being not only thicker but often as long as all the rest combined, but in a few, as in *C. albifasciatus*, it is so small as to be scarcely visible except on close inspection, being quite hidden among the scales that clothe the end of the fourth joint. The same is the case in the group of species allied to *C. tæniorhynchus* and also in *C. dolosa*, Arribálzaga. Nearly all the common house-pests of all countries belong to this Genus, but a considerable number are found in the open country and in woods. Probably, with the exception of the Polar Regions, no at all extensive land surface is free from them.

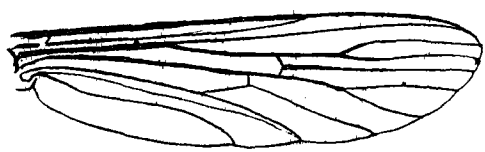
The following description, extracted from Skuse's Monograph of the Australian *Culicidæ*, is like his other generic descriptions fuller and more detailed than the classical definitions of the Genus. It will be noticed that he describes the male palpus as *six* jointed, while other authors give the number of joints as five. This is due to Skuse's regarding the basal piece as really composed of two articulations, and there certainly does exist a deceptive appearance of a constriction in some species, but as far as I have been able to personally test the question, I should prefer to adhere to the old-established description of five joints.

Culex, "Linn. Syst. Nat.," 1735; "Fauna Suecica," 1761; Geoffroy, "Hist. N. Ins.," 1764; Fabr. "Gen. Ins.," 1776, p. 203; "Ent. Syst.," 1794; Latreille, "Gen. Cr. et Ins." IV., 1809, p. 246; Meig. "Syst. Beschr." I., 1818, p. 1; Macquart, S. à B., I., 1834, p. 33; Curtis, "Brit. Ent.," Vol. XII., 1835, p. 537; Zetterstedt, "D. Sc.," 1850; Walker, I. B., III., 1856, p. 243; Schiner, "F.A.," II., 1864.

Head small, almost globose, placed moderately deep in the thorax; eyes lunular, emarginate at the insertion of the antennæ, approximate above; ocelli wanting; palpi porrect, clothed with scales, longer than the antennæ in the ♂, six jointed, the three last joints hairy, the first two joints short, the third long and slender, the fourth longest, clavate, fifth and sixth about equal length; in the ♀ very short, five jointed, first joint rather longer than the second, membranous at the base, second small, third clavate, fourth longest and stoutest, fifth extremely small, nipple-shaped or gemmiform; proboscis long, slender, densely clothed with scales, straight or a little bent. Antennæ porrect, about the length of the thorax, shorter than the proboscis, 2 × 12 mm. jointed, the first joint of the scapus large and globose; in the ♂ second rather longer and stouter than the first flagellar joint, whorled, with very long hair towards the apex; the ten following flagellar joints short, fusiform, whorled in the middle with very long hair, the penultimate joint greatly elongated, beyond the whorl, terminal joint long, but shorter than the preceding, and slender, like its continuation, with a few moderately long hairs forming a verticil at the base, clothed with short hairs; in the female the second joint of the scapus is stouter and rather longer than the following joints, sparsely verticillate-pilose at the base. Thorax longish ovate, arched; scutellum small; metathorax steep; halteres small; abdomen slender, almost cylindrical, with eight segments in both sexes; in the ♂ terminating with holding forceps; the ovipositor of the ♀ with short terminal lamellæ. Legs long and slender, especially the hind pair; coxæ short; tibiæ spinulose; tarsi long; metatarsus very long; terminal joint longest in the hind legs; ungues small, acute.

Wings longer than the abdomen, narrow, elongate, lanceolate, densely ciliated, the veins chiefly covered with linear scales; incumbent in repose; humeral and sub-costal cross-veins present, the latter placed before the middle of the auxiliary vein. Marginal transverse wanting; second longitudinal starting from the first, a short distance beyond the sub-costal transverse, and at a point

before half the length of the wing, terminating in a long narrow fork, the branches running parallel; third longitudinal originating from the second, at a point much nearer the base of the fork than to the origin of the latter. Middle transverse placed close to the base of the third longitudinal; fourth longitudinal ending in a shorter and broader fork than that of the second; their bases more or less opposite; posterior transverse placed more or less before, or almost in a line with, the middle cross-vein; fork of the fifth longitudinal nearly as broad as those of the second and fourth longitudinal veins taken together, as long as, or a little longer than that of the former, its base generally placed at a point midway between the base of the second longitudinal



The Wing in *Culex*.

and the tip of the sixth longitudinal, sometimes beyond; sixth longitudinal vein slightly arcuated, joining the wing margin before the posterior transverse vein.

Skuse's detailed description must, however, be taken as representing only the usual details of structure of the Genus, from which individual species vary considerably, the only really essential characters being those indicated in the table of Genera.

Table of the Species of the Genus CULEX.

A. With the wing spotted by alternations of dark and light colouring on the costa.

I. Tarsi with lighter banding.

a. Abdominal segments with lighter basal bands.

1. *C. mimeticus*. Noè. Presents a close general resemblance to *Anopheles superpictus*, Grassi.

II. With the tarsi uniformly coloured?

q. Abdomen with a fuscous line.

2. *C. Hyrcanus*, Pallas. With black spots along the costa.

B. With the wing spotted by accumulations of scales; costa uniformly coloured.

I. Tarsi with lighter bands on some of or all the joints.

i. The scales covering the body present the usual silky appearance.

a. Abdominal segments with basal lighter bands.

3. *C. annulatus*, Schrank. Palpi of ♂ not markedly spatulate; five wing-spots.

4. *C. spathipalpis*, Rondani. Palpi of ♂ markedly spatulate; three wing-spots.

5. *C. longiareolatus*, Macqt. Wings with four spots placed as in *C. glaphyropterus*; both fork cells exceptionally long.

b. Abdominal segments with darker incisuræ, *i.e.*, with apical lighter bands.

6. *C. Bigotii*, Bellardi. With three black wing-spots.

7. *C. fulvus*, Wied. With a single brownish-black patch at the apex of the wings.

8. *C. penetrans*, Desvoidy. With five more or less distinct wing-spots.

ii. Body covered with a rough or woolly tomentum.

a. Abdominal segments with lighter basal bands.

9. *C. laniger*, Wied. Veins of the wings with alternate fuscous and white scales; internal marginal fringe banded fuscous and white (perhaps rather a brindled than spotted species).

b. Abdominal segments with apical lighter bands.

10. *C. hispidosus*, Skuse. With two pale fuscous spots on the wing-field, and the internal fringe banded.

c. Abdominal segments with a bright longitudinal streak.

11. *C. mucidus*, Karsch. A black patch in the middle of the wing, its internal fringe banded.

II. Tarsi uniformly tinted, without bands.

i. With the scales of the usual silky appearance.

a. Abdominal segments with basal lighter bands.

12. *C. glaphyropterus*, Schiner. With four or five distinct black wing-spots.

C. Species in which the wings are unspotted.

I. Tarsi with lighter bands on some of or all the joints.

i. With the lighter rings on the bases alone of the tarsal joints.

a. With the thorax dorsally adorned with pale lines on a darker ground.

a. Abdominal segments with basal white bands.

13. *C. tæniatus*, Meig. Thorax with a white V, and two lateral semilunar marks.

14. *C. Bancroftii*, Skuse. Thorax brown, with two sub-median longitudinal and two lateral curved white lines.

15. *C. alboannulatus*, Macqt. Thorax red-brown, with five bare, white-scaled lines.

16. *C. mosquito*, R. Desvoidy. Thorax dark coloured? with silvery puncta and large lateral silvery marks.

17. *C. scutellaris*, Walker. Thorax dark brown, with a median and two lateral snowy stripes.

c. Abdominal segments with yellowish basal bands.

18. *C. notoscriptus*, Skuse. Thorax deep brown, with elaborate silvery adornment (*vide* description).

19. *C. cantans*, Meig. Thorax red-brown, with two lines of white tomentum on faint brown ground.

d. Abdominal segments with apical white bands.

20. *C. vittatus*, Bigot. Thorax brown, with white marks on the dorsum and pleuræ.

e. Abdominal segments with lateral dots in addition to basal lighter bands.

21. *C. albopictus*, Skuse. Thorax black, with a median line in front and the pleuræ spotted silvery.

22. *C. exagitans*, Walker. Thorax brown, with two slender whitish stripes.

23. *C. sugens*, Wied. Thorax yellow-brown, with white spots and marks, as well as darker longitudinal lines.

f. Abdomen unbanded but with lateral white spots.

24. *C. Kounoupi*, Brullé. Thorax dark red, with the pleuræ paler, and both adorned with silvery marks.

25. *C. viridifrons*, Walker. Thorax brown? with three grey stripes; abdomen pale with lateral brown stripes interrupted by white dots; frons greenish.

26. *C. titilans*, Walker. Thoracic adornment not stated; proboscis with a yellowish band in the middle.

27. *C. fasciolatus*, Arribálzaga. Thorax piceous, with a broad medium testaceous line; proboscis with three white bands.

g. Abdomen unadorned with bands or spots?

28. *C. fasciatus*, Fabr. Thorax black, with a white dorsal line; proboscis with three white bands; abdomen light brown.

29. *C. vittiger*, Skuse. Thorax black, with five equi-distant whitish vittæ; proboscis with an indistinct ochreous band; abdomen whitish.

h. Thorax with darker marks on a lighter ground.

a. The abdominal segments with white basal bands.

30. *C. calopus*, Meig. Thorax grey, with four longitudinal brown lines; abdomen with white spots on the venter laterally.

31. *C. annulipes*, Meig. Thorax dark ferruginous, with two darker converging lines.

Abdomen unbanded, but with lighter lateral spots.

32. *C. Richardii*, Ficalbi. Thorax brown, golden-scaled, with two darker spots on either side; abdomen with six trapezoid yellow lateral spots.

s. Abdomen adorned with darker lateral spots.

33. *C. solicitans*, Walker. Thorax with two black stripes; abdominal segments with a pair of lateral black spots; proboscis with a distinct lighter band in the middle.

tt. Abdomen not stated to be dorsally banded, but with light bands on the venter.

34. *C. terrens*, Walker. Thorax white-pubescent, with two brown stripes.

γ. Thorax unadorned, or not stated to be so.

a. Abdominal segments with lighter basal bands, the proboscis unbanded.

35. *C. malariæ*, Grassi. Thorax undescribed; palpi of the male vaguely banded.
36. *C. cingulatus*, Fabr. Testaceous, with the proboscis and hinder tarsi banded white.
37. *C. vexans*, Meig. Thorax dark brown; abdominal bands white
38. *C. excitans*, Walker. Thorax clothed with white hair; abdominal bands white.
39. *C. stimulans*, Walker. Thorax brownish-red; abdominal bands yellow.

aa. Abdominal segments with lighter basal bands; the proboscis more or less distinctly banded.

40. *C. tæniorhynchus*, Wied. Thorax dark fawn; proboscis with a distinct band in middle.
41. *C. confinnis* (Arribálzaga). Thorax piceous; proboscis with a broader white band in the middle.
42. *C. albirostris*, Macqt. Thorax cinereous; band on proboscis extremely broad.
43. *C. longipalpis*, Van der Wulp. Thorax red-brown; proboscis with broad yellowish band: ♂ palpi very long.
44. *C. annulirostris*, Skuse. Thorax deep brown, golden-scaled; proboscis with broad white band in middle.
45. *C. sitiens*, Wied. Thorax brown; proboscis with a whitish band beyond the middle.
46. *C. rubrithorax*, Macqt. Thorax brick-red; proboscis tawny in the middle, black at base and tip (generally).

e. Abdominal segments with lateral dots in addition to lighter basal bands.

47. *C. vigilax*, Skuse. Thorax black, golden-scaled; abdominal bands narrow, yellow; lateral patches white; a tendency to banding of the proboscis.
48. *C. inpatabilis*, Walker. Pectus with white dots; abdomen with interrupted white bands, most complete beneath, *i.e.*, with a band in the middle and lateral dots?

h. Abdominal segments with both the fore and hinder borders pale.

49. *C. procax*, Skuse. Thorax red-brown, with golden-scales; abdominal segments black, narrowly white in front, yellow-fringed behind; auxiliary vein ends a little before hinder branch of fifth longitudinal, proboscis indistinctly banded.

50. *C. flavifrons*, Skuse. Like preceding but auxiliary vein ends opposite tip of hinder branch of fifth longitudinal.

51. *C. occidentalis*, Skuse. Like the last, but with palpi of ♀ with white ring at the base.

k. Abdominal segments with both fore and hind borders, and a median line yellowish.

52. *C. maculiventris*, Macqt. Thorax black with rufous tomentum.

m. Abdominal segments with bands of two tints, neither markedly the lighter.

53. *C. excrucians*, Walker. Thorax red; abdominal segments testaceous and brownish.

n. Abdominal segments speckled white, but unbanded.

54. *C. dives*, Schiner. Thorax dark brown; frons white.

g. Abdomen unadorned with bands or spots?

55. *C. tibialis*, Desv. Thorax fuscous, with grey tomentum; abdomen uniformly black.

56. *C. imprimiens*, Walker. Thorax and abdomen alike testaceous.

57. *C. toxorhynchus*, Macqt. Thorax black; abdominal segments brown, rather darker behind; proboscis upturned at end.

58. *C. inexorabilis*, Walker. Thorax dark brown; abdomen wanting.

59. *C. flavicosta*, Walker. Thorax and abdomen tawny, unadorned; costa of wing yellow; tarsal bands testaceous.

ii. The lighter tarsal rings are on the apices of the joints.

α. Thorax with lighter marks on a darker ground.

g. The abdomen unadorned with bands or spots.

60. *C. argyropus*, Walker. Thorax black, with silvery spots on the sides.

γ. Thorax unadorned with lines or spots.

g. The abdomen unadorned with bands or spots.

61. *C. camptorhynchus*, Thomson. Thorax dusky, with fulvous tomentum; proboscis curved.

iii. Tarsal bands formed by the joints being lighter at both ends, two joints contributing to each band.

α. Thorax with lighter marks on a darker ground.

a. Abdominal segments with basal white bands.

62. *C. signifer*, Coquillett. Thorax nearly black, with two median and two lateral curved silvery lines; wings brindled.

63. *C. tarsalis*, Coquillett. Thorax black, with yellowish tomentum, a dorsal and two curved lateral grey vittæ; wings brindled; tarsal bands very broad.

b. Abdomen with a median white line, in addition basal white bands to the segments.

64. *C. dorsalis*, Meig. Thorax dusky, with a pair of divergent yellowish lines.

c. Abdominal segments light, with dark median line and lateral spots.

65. *C. penicilaris*, Rondani. Thorax of a brazen hue, with a line of lighter colouring on either side of middle line.

β. Thorax with darker marks on a lighter ground.

a. Abdominal segments with basal white bands.

66. *C. leucacanthus*, Loew. Thorax brazen, with two faint darker longitudinal lines; palpi of ♂ whitish.

γ. Thorax unadorned.

p. Abdominal segments with lighter basal bands the position of which is not defined.

67. *C. pulchritarsis*, Rondani. Palpi of the ♀ whitish at base, black at the apex.

68. *C. pulchripalpis*, Rondani. Palpi of the ♂ white at the apex.

iv. Tarsi not alternately banded, but with a single white portion on some of, or all the legs.

γ. Thorax unadorned.

e. Abdominal segments with lateral spots, in addition to basal lighter bands.

69. *C. musicus*, Say. Thorax purple-black; abdominal marks yellowish; the two last joints of hind legs white.

g. The abdomen unadorned with bands or spots.

70. *C. discrucians*, Walker. General coloration steel-blue with grey and silvery scales; a white band on fourth joint of hind legs alone.

71. *C. posticatus*, Wied. Like the preceding: both have the venter banded, but in this species with silvery, while in *discrucians* the bands are golden.

v. Tarsal joints without complete bands but with basal white spots.

δ. Thorax undescribed.

a. Abdominal segments, with lighter basal bands.

72. *C. articulatus*, Rondani. The tarsal adornment is unique.

vi. Species with the tarsi banded, but in which the position of the bands is not defined. (These must necessarily really belong to one of the four preceding classes of tarsally banded species, but cannot be placed).

a. Thorax with lighter marks on a darker ground.

a. Abdominal segments with lighter basal bands.

73. *C. Caspius*, Pallas. Thorax brown, ? with grey stripes, otherwise like *C. pipiens*, L.

74. *C. vagans*, Wied. Thorax rather deep clear brown, lighter in the middle.

d. Abdominal segments with apical lighter bands.

75. *C. aureostriatus*, Doleschall. Thorax black with five golden lines.

76. *C. Willistoni*, Mihi. Thorax brown, with two short lateral lines behind.

e. Abdomen with lateral spots in addition to lighter bands.

77. *C. variegatus*, Doleschall. Tips of the tarsi white, "legs with white bands;" thorax black with median stripe and hind border white.

f. Abdomen unbanded, but with lighter lateral spots.

78. *C. formosus*, Walker. Thorax deep red-brown, with four silvery stripes; abdomen red-brown with silvery spangles.

q. Abdomen unbanded, but with a median darker line.

79. *C. bipunctatus*, Desv. Thorax dark red, with two silvery spots in front; abdomen yellow with brown line.

t. Abdomen unknown (missing).

80. *C. conterrens*, Walker. Thorax fuscous, with a testaceous stripe.

Thorax with darker marks on a lighter ground.

g. With the abdomen unadorned.

81. *C. nero*, Doleschall, Thorax with some black stripes; generally black.

γ. Thorax unadorned.

ab. Abdominal segments with basal cinereous bands.

82. *C. parvus*, Macqt. Otherwise like *C. pipiens*, L.

d. Abdominal segments with apical lighter bands.

83. *C. Nicaensis*, Leach. Thorax brown; lighter abdominal bands cinereous.

g. Abdominal segments not stated to be adorned.

84. *C. conopas*, Frauenfeldt. Of a generally ochreous tint.

85. *C. annulitarsis*, Macqt. Of a generally fuscous tint.

86. *C. zonatipes*, Walker. Generally ferruginous.

p. Abdominal segments with lighter bands, the position of which is not defined.

87. *C. alternans*, Westwood. Generally pale brownish.

II. Tarsi unbanded.

α. Thorax with lighter marks on the darker ground.

a. Abdominal segments with basal white bands.

88. *C. pusillus*, Macqt. Thorax blackish, with whitish lines; legs pale yellow.

89. *C. impudicus*, Ficalbi. Thorax dark brownish-grey, with two brazen lines; claspers of ♂ exceptionally large.

90. *C. punctor*, Kirby. Thorax dark chocolate-brown, with five white-scaled lines; legs dark testaceous.

c. Abdominal segments with basal yellowish bands.

91. *C. linealis*, Skuse. Thorax brown, with four parallel golden lines, the two middle ones very close together.

92. *C. Skusii*, Mihi. Thorax orange-brown, with two sub-median and two lateral curved lines.

93. *C. impatiens*, Walker. Thorax with three lighter brown stripes, the middle one forked at the tip.

94. *C. pungens*, Wied. Thorax bright red-brown, with two clear yellowish lines in certain lights.

f. Abdominal segments unbanded, but with white lateral spots.

95. *C. atripes*, Skuse. Thorax with prothoracic lobes; a spot in front of the wings, and pleuræ silvery.

qq. Abdomen with a median lighter line, unbanded.

96. *C. albifasciatus*, Macqt. Thorax ferruginous, with median stripe and broad lateral lines of golden yellow.

β. Thorax with darker marks on a lighter ground.

a. Abdominal segments with basal white bands.

97. *C. fatigans*, Wied. Denuded thorax with three darker lines, which show as slender, bare intervals in the golden tomentum, in the fresh insect.

98. *C. pallipes*, Meig. Thorax reddish-brown, with two dark stripes.

99. *C. ornatus*, Meig. Thorax yellowish-white, with two converging submedian streaks, and often two others at the sides.

ab. Abdominal segments with grey basal bands.

100. *C. fuscanus*, Wied. Thorax with grizzly hairs so arranged that the dusky ground shows as four darker lines.

c. Abdominal segments with yellowish basal bands.

101. *C. sagax*, Skuse. Thorax piceous, with gold and white scales and three rows of brown hairs, median shortest ending in a bare space.

102. *C. dolosus*, Arribálz. Decoration of thorax closely resembles that of the preceding, but the general coloration of the insect is reddish, in place of nearly black.

103. *C. flavipes*. Macqt. Thorax coloured like preceding, but with two in place of three, and ill-marked lines.

104. *C. nemorosus*, Meig. Thorax with (generally) four darker lines; abdominal bands of a lighter yellow than in the above.

d. Abdominal segments with whitish apical bands.

105. *C. geniculatus*, Olivier. Thorax cinereous, with two blackish lines near the middle and two at the sides.

106. *C. territans*, Walker. Thorax pale brown, with three darker (?) thin reddish lines.

dd. Abdominal, apical segmental bands yellowish.

107. *C. æstuans*, Wied. Thorax rather clear brown, with a single deeply tinted stripe.

108. *C. concolor*, Desv. Thorax pale rufous, with three indistinct brown lines.

f. Abdominal segments unbanded, but with light lateral spots.

109. *C. lateralis*, Meig. Thorax light grey, with the sides and two converging lines blackish; abdominal lateral spots white.

110. *C. rubidus*, Desv. Thorax reddish with a black line; abdominal lateral spots yellow.

ff. Abdominal segments unbanded, but with darker lateral marking.

111. *C. punctatus*, Meig. Thorax greyish-brown, with four longitudinal lines, whether darker or lighter not stated; abdomen with darker lateral spots.

112. *C. testaceus*, Van der Wulp. Thorax with indistinct darker lines; abdomen brownish-yellow, with darker lateral lines.

g. Abdomen unbanded.

113. *C. thoracicus*, Desv. Thorax brownish-yellow, with two brownish streaks.

114. *C. acer*, Walker. Thorax pale yellow, with three brownish stripes.

115. *C. bicolor*, Meig. Thorax greyish-chestnut, with traces of darker stripes.

h. Abdomen with bands formed on the contiguous borders of two segments.

116. *C. Macleayi*, Skuse. Thorax deep brown, with golden scales traversed by two bare (darker) lines.

p. Abdomen with bands the position of which is not defined.

117. *C. calcitrans*, Desv. Thorax reddish, with three brown stripes; proboscis yellow.

qq. Abdomen unbanded but with a median lighter line.

118. *C. agilis*, Bigot. Thorax fuscous, with four indistinct black lines; abdominal line formed by a string of pale brown spots.

ββ. Thorax with the pleuræ spotted, although dorsally unadorned.

a. Abdominal segments lighter in front.

119. *C. salinus*, Ficalbi. Thorax dark umber-brown, with spots of whitish scales on the pleuræ; hind border of abdominal segments speckled hazel.

c. Abdominal segments with basal yellowish bands.

120. *C. phytophagus*, Ficalbi. Thorax yellowish-brown, pleuræ paler with white-scaled patches; ground colour black.

e. Abdominal segments with lighter lateral spots, in addition to basal light bands.

121. *C. guttatus*, Curtis. Thorax reddish-black, pleuræ grey, with about six white spots.

f. Abdominal segments unbanded but with lighter lateral spots.

122. *C. triseriatus*, Say. Thorax rather dark blue, pleuræ with two white hairy spots; abdominal lateral spots triangular; there is a third series on the venter.

. Thorax unadorned.

a. Abdominal segments with basal white bands.

123. *C. australis*. Erichson. Thorax golden-scaled; knees and apices of tibiæ white.

124. *C. crucians*, Walker. Abdominal lighter bands of a rather reddish tint, probably a synonym of the preceding; knees unspotted?

125. *C. nigripes*, Zetterstedt. A very darkly-tinted species; the abdomen uniformly black in the ♂; knees unspotted.

126. *C. confirmatus* (Arribál). Thorax silvery-grey, with some golden scales; knees unspotted.

127. *C. inornatus*, Williston. Only the first two abdominal segments are basally white, the remainder uniformly black.

128. *C. stiticus*, Meig. Thorax black, with rufous tomentum; knees unspotted.

129. *C. impiger*, Walker. Closely resembles *C. pipiens*, but the abdominal bands whiter.

b. Abdominal segments with grey basal bands.

130. *C. nigritullus*, Zetterstedt. Thorax brownish-ferruginous; like *C. nemorosus*.

c. Abdominal segments with yellowish basal bands.

131. *C. pipiens*, L. Thorax pale testaceous, black when denuded; the abdominal bands expand laterally.

132. *C. ciliaris*, L. Like *C. pipiens*, but with less contrasted abdominal banding.

133. *C. detritus*, Haliday. Like *C. pipiens*, L., but larger.

134. *C. provocans*, Walker. Like *C. pipiens* but redder, and with the hairs of the body white instead of golden.
135. *C. perterrens*, Walker. Abdomen purplish, with testaceous bands.
136. *C. nigrithorax*, Macqt. Thorax black, as also the entire last abdominal segment.

d. Abdominal segments with white apical bands.

137. *C. hortensis*, Ficalbi. Thorax yellowish-grey; knees with white spots.
138. *C. incidens*, Thomson. Thorax fuscous, marbled with fulvous scales; abdominal bands form a mere fringe; tibiæ whitish at the apex, but knees unspotted.

dd. Abdominal segments with yellowish or reddish apical bands.

139. *C domesticus*, Germar. Thorax pale yellow.
140. *C. meridionalis*, Leach. Thorax greyish-brown.
141. *C. crassipes*, Van der Wulp. Thorax clear reddish-brown; venter with darker lateral spots on the first four segments.

f. Abdominal segments unbanded, but with lighter lateral marks.

142. *C. cyaneus*, Fabr. Thorax steel-blue; abdomen the same, with a silvery lateral line.

ff. Abdominal segments unbanded, but with darker lateral spots.

143. *C. rusticus*, Rossi. Thorax "brownish-grey," or "black with yellowish tomentum."

g. Abdominal segments unadorned.

144. *C. lutescens*, Fabr. Of a generally uniform yellowish colour.
145. *C. ochripes*, Macqt. Generally uniformly yellowish-brown.
146. *C. fusculus*, Zetterstedt. Thorax ferruginous; abdomen black.
147. *C. setulosus*, Doleschall. Closely resembles the preceding, but has the venter with dark bands.
148. *C. modestus*, Ficalbi. Of generally dark grey and brown tints, with only a few yellowish specks on the abdomen.

149. *C. oblitus* (Arribál). Hoary or dark cinereous. *Vide* generic characters of *Janthinosoma*, Arribál.

qq. Abdomen unbanded, but with lighter median marking.

150. *C. obturbans*, Walker. Abdomen coppery-green with a white dot near the tip.

Imperfectly described species in which the tarsi are not stated to be banded, but which cannot be tabulated owing to want of data.

I. Species in which the abdomen is said to be "banded."

151. *C. Doleschallii*, Mihi = *C. cingulatus*, Dol. *nec* Fabr.

152. *C. ventralis*, Walker.

153. *C. siculus*, Desv.

154. *C. rufinus*, Bigot.

155. *C. luridus*, Doleschall.

II. Species in which no mention is made of any banding of the abdomen.

156. *C. molestus*, Wied.

157. *C. melanorhinus*, Mihi = *C. pallipes*, Macqt. *nec* Meigen.

158. *C. pinguis*, Lord.

159. *C. filipes*, Walker.

A.—Species in which the Wings are Spotted.

In some of the species included in this category it is probable that the spots are of no very pronounced character, but it was considered, on the whole, less likely to give rise to mistakes to include all species in which the descriptions indicate anything of the nature of a spot.

1. **CULEX MIMETICUS,** Noè (1899).

Wings spotted; its anterior margin black, interrupted by three linear, pale yellow intervals about equal to the black spots in length. Body with smooth tomentum? Abdominal segments with pale basal bands; tarsal joints with white basal bands. The femora of the middle legs are thickened at the base. A small species which mimics *An. superpictus*, the wings presenting a strong superficial resemblance to those of that species. Length about 5-6 mm.

Habitat.—Italy. Often found in localities where *An. superpictus* is common.

2. **CULEX HYRCANUS**, Pallas (1771).

Wings with black spots along the costa; tarsi without bands. General colouration grey.

Description from Pallas, "Reisen durch das Russisch. Reich." Somewhat above the average size, grey, rather hirsute; the abdomen with a fuscous line. Frons hairy. Antennæ three jointed (the entire verticillate portion being presumably considered as a single joint), the last with three nodes, and the basal portion with black, subpennate hairs. *Palmi nulli?* Proboscis nude, straight, outstretched, nearly the length of the abdomen, with the base hairy, and a broad terminal dilatation. Legs very long, grey, not markedly hirsute, the hinder pair nearly thrice as long as the body, the tarsi being especially long. Wings lanceolate, cinereous, the veins hirsute, with black spots along the thicker margin, glabrous above, but with the veins hirsute below?

Habitat.—Found in company with *C. Caspius*, near the Caspian Sea, but less common and more vicious.

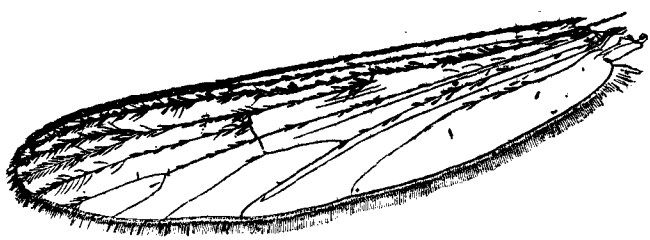
B.—Species in which the Wings are Spotted by Accumulations of Scales.

3. **CULEX ANNULATUS**, Schrank.

With five or, more rarely, four black wing-spots. Tomentum smooth; tarsi conspicuously banded; thorax not dorsally ornamented; palpi of the male longer than the proboscis.

Description from "F. R.," p. 239-242. *C. variegatus*, Schrank, 1781 (?); *C. affinis*, Stevens, 1825; *C. Ficalbii*, Noè, 1899.—Proboscis darker above than below, very dark at the apex, and more or less speckled with whitish at the base, the proportions of dark and light varying in different individuals, and generally lighter in the ♂. The last joint of the palpi of the ♂ somewhat clubbed, but less spatulate than in *C. spathipalpis*; very hirsute; nearly black, with

four whitish rings, one at the root, and the other three on the articulations between the last three joints; the antepenultimate joint armed with a large brush of long brown hairs on its outer side. Palpi of the ♀ black, with a yellowish white spot in the middle, and speckled white at the apex. Antennæ of the ♀ brown, with the rotund basal joint bordered with pale yellow scales, and yellowish rings at the roots of the verticils; in the ♂ the basal joint is as in the ♀, but the hairs of the plume are black for their terminal half, and flaxen in the basal, the stem being pale, with minute black rings. The eyes are dark metallic green and red, bordered with whitish tomentum. The ground colour of the nape is brown, but it looks grey, on account of a covering of whitish scales and hairs. The



Wing of *Culex Annulatus*, partly denuded.

colouration of the thorax does not afford good characteristics, as it varies greatly in different individuals, and so may be marked in a manner characteristic of other species, quite distinct from it. It generally has a more or less castaneous tint, the bright yellow ground-colour showing through a clothing of brown hairs; but sometimes may have one or two pairs of bright yellow streaks, and more laterally a pair of blackish streaks, which last are more distinct in the ♂, in whom the thorax is generally more yellowish. Pleuræ lighter than the rest of the thorax, greyish-yellow about the origins of the wings, and below speckled yellow in front, and darker and glabrous behind; scutellum dusky yellow, glabrous; halteres nearly black

with a yellowish stem. Wings brownish, with five or, more rarely, four spots formed by accumulations of black scales, which are placed in exactly the same positions as in *An. claviger*, with the usual addition of a fifth spot at the base of the fork of the fifth longitudinal. Costa with a few white mixed with its mostly black scales; veins and posterior margin black-scaled. Stems of the two fourchettes of about equal length; the branches of the anterior, a little longer than the hinder, and than their own stem. Anterior branch of hinder fourchette, nearly equal to its stem, and a little longer than the hinder; coxæ brownish yellow, speckled whitish. Femora above, black, speckled whitish, with a single whitish ring on the lowest fifth; beneath, whitish as far as the ring, and quite black below it. Knees whitish. Tibiæ black, with white specks, a whitish internal border, and minute white rings above and below, the lower one blending with that on the first tarsal joint. Tarsi black with five whitish rings, the first blending with the lower tibial ring, the second in the middle of the first tarsal, and the third, fourth and fifth, at the bases of the second, third and fourth joints, the third being the broadest, the rings being most distinct on the hind legs; the last tarsal joint entirely black. The abdomen is densely clothed laterally with fine whitish hairs, especially in the ♂, the segments dorsally black, with a white basal band which is somewhat broader at the sides than in the middle, the second segment (or first, according to Fabricius) being additionally marked with a white median line; ventrally the segments are yellowish in the middle, with a white lateral spot, followed by a black one, on either side, five or six of these being easily made out. In the ♂, the black spots are almost triangular, and are especially distinct from the third to the seventh segments. Total length of ♀ including the proboscis, 10-12 mm., of the ♂ 9-12 mm., but he is a little more slightly built.

Habitat.—This large gnat is widely diffused through Europe; Zetterstedt records it from Lapland and Scandinavia; Siebke from Norway; Stevens and Walker from England; Gimmerthal from Russia; Schiner from Austria;

Meigen from Germany; Macquart from France, and Ficalbi from Italy, Sardinia and Sicily. Ficalbi believes that it feeds on the juices of plants, and that it does not attack man or animals.

Captain Victor Lindesay, I.M.S., has just sent me a ♀ specimen of a large *Culex* from Bakloh, Punjab, which agrees in practically all respects with the above description and is in all probability identical. As the climate of this part of the Himalayas is quite European, there seems nothing improbable in this.

Noè's new species, *C. Ficalbii*, is said to differ from the above only in the absence of a white ring on the distal third of the femora, but this hardly appears sufficient basis for the institution of a new species.

4. **CULEX SPATHIPALPIS,** Rondani, 1872.

Wings with three black spots formed by accumulations of scales; tarsi with obvious bands; tomentum smooth; thorax dorsally ornamented with white marks; palpi of the male rather shorter than the proboscis, the last joint somewhat spatulate (approaching the characters of *Anopheles*).

Description from "F. R.," p. 242-246.—Proboscis black; proboscis longer than the palpi by half the length of the end joint of the latter, in the ♂; scantily villous; dark brown with four delicate white rings; the last joint olive-shaped and much dilated, the next being also enlarged at its articulation with it; of the ♀ black, speckled white; quite black just at the base, white just at the apex, with a more or less evident white ring in the middle. Antennæ of the ♀ with the globular basal and the two following joints whitish, bordered with pure white; the other joints, saving the last, which is nearly black, are dark brown with a white tomentum; of the ♂ with the first joint brown, bordered with white, the second, mostly white, and the rest of the antennæ brownish black; eye dark iridescent green, with a white border; nape blackish, with two converging, longitudinal, white lines above. Thorax, with the dorsum rather clear umber, with a more velvety appearance than in *C.*

annulatus; with bright yellow bristly hairs laterally, and behind above the scutellum; a white median line tapering behind, reaching from the front nearly to the hinder border; opposite the posterior extremity of this, two lateral and converging white spots, and in front of these and more laterally, two others of semilunar form, with their convexity outwards and their posterior extremity produced into two fine curved lines, reaching to the hinder border of the thorax; finally, another pure white linear spot above and before the root of each wing; laterally the thorax presents three bands forming continuations of the white on the coxæ; the pectus is ornamented in front with a white V. Scutellum glabrous, brownish yellow; halteres brownish yellow. Wings with the costa white, and three black-scaled spots, placed respectively at the first anterior bifurcation (*i.e.*, the root of the second longitudinal vein), on the transverse vein joining the stems of the two fourchettes with the vena interposita, and at the bifurcation of the fifth longitudinal, and occasionally with traces of two additional spots at the bases of the two fork-cells; in the ♂ the two first spots are alone distinct; stems of both fourchettes short, with long branches. Legs; coxæ, hazel-tinted, with an external white spot; those on the fore legs forming a sort of truncated V, behind and below that on the venter of the thorax; femora yellowish at the base, and to a less extent at the apex; the remainder striped with two white and two black streaks, the white augmenting below to form a partial white ring on its lower fifth; knees white. Tibiæ striped with black and white, speckled with black; first tarsal joint streaked black and white, the former preponderating, and with a rather narrow white basal ring; the hind legs with white rings on the second, third and fourth tarsal joints, which are otherwise black; the fourth and fifth in the fore and middle, and the fifth joint in the hinder legs entirely black; abdomen with discrete, but rather numerous clear yellow hairs, rather short in the ♀, somewhat longer in the ♂. The segments, in the ♀ hazel-yellow, speckled with scattered black scales, which sometimes coalesce to form indistinct spots, with a

basal white band, extending backwards in triangular form on the second segment, and produced at its lateral termination into short longitudinal lines, the third, fourth and fifth segments having triangular median areas quite free from black specks; eighth segment generally white, except at the apex. In the ♂, the segments are white for the anterior fourth, and the rest black, speckled with hazel, saving a median triangular hazel area with the apex forwards, most distinct on the middle segments; the last segment with the white preponderating. Ventrally the segments in the ♀ are thickly clothed with white scales, somewhat speckled laterally with hazel and black scales; in the ♂ they are ivory-white, bluish in places, with traces of black at the sides, and also to a less extent in the middle, especially on the fourth, fifth and sixth segments. Length, including the proboscis, in the ♀, 11-15 mm.; in the ♂, 9-11 mm., he being also more slender.

Habitat.—Throughout the greater part of Italy and its larger islands. Ficalbi has not found it to suck blood, and believes it to feed on the juices of plants. He has observed its larvæ in the depth of winter.

5. **CULEX LONGIAREOLATUS,** Macquart.

Wings with four spots, formed by accumulations of scales, arranged exactly as in *C. glaphyropterus;* tarsi with basal light bands to the joints; abdomen appears to have had basally banded segments. The fork-cells exceptionally long with much shorter stems.

Description from Macquart, "Dip. Exot." I., p. 34. Webb and Berthelot, "Hist. Nat. des Iles Canaries." Fuscous; palpi black; the last joint, as well as the posterior, white; wings with the first sub-marginal and second posterior cells equally, exceptionally long. Length 3 lines (♀). Specimen in bad condition.

Palpi black; eyes of a rather bronzy green. Legs wanting. Wings with the first submarginal and second posterior cells of equal length (their bases at the same level) and longer than usual; the two small transverse veins nearly at the same level.

In the British Museum collection there is a ♀ specimen from the Canaries, so labelled which corresponds well with the above description, so far as it goes. It cannot, however, be said to be nearest *C. cantans*, as the wings are distinctly spotted as in *C. annulatus* and its allies, and it closely resembles that group of species. It is a large insect of a generally golden-brown tint, the ground colour dark, but generally hidden by much golden tomentum. The eyes have a distinct silvery margin. There appear to have been some white and black markings on the nape, and the thorax may also have been so decorated. The palpi are fulvous, with the apex white, and remains of some white banding at the articulations. The tarsal joints have basal white bands, but the abdomen is too rubbed to be sure as to its adornment. The great length of the fork-cells is very characteristic.

Habitat.—The Canary Islands. Near *C. cantans*, but differs somewhat in nervation.

6. **CULEX BIGOTII**, Bellardi.

Wings with three black spots, formed by accumulations of scales; tarsi with paler bands; tomentum smooth; thorax not figured, but dusky yellow with the dorsum darker; palpi of the male a little longer than the proboscis; abdomen black, with broad yellow apical bands to the segments.

Description from Bellardi. (Mem. R. Accad. Torino, Ser. 2, Tome XXII., p. 200). ♀.—Yellow; with yellowish black tomentum; head dusky with yellow tomentum. Antennæ dusky; their basal joints yellowish in front and behind; palpi yellow with black villosity at their bases; the proboscis rather long, yellow, irregularly black-scaled at the base and fuscous at the apex. Thorax somewhat convex, dusky yellow, darker on the dorsum, with golden-yellow tomentum, and the pleuræ yellow; pectus fuscous; scutellum, metathorax, and halteres yellow; abdomen yellow with a band of black tomentum across the front of each segment, broad, with the dorsum deeply emarginate behind;

legs yellow, with black tomentum; the joints pale, without black tomentum. Wings hyaline, yellow on the anterior margin; veins with black scales, arranged in three spots near the margin and apex; the intervening scales yellow; length of the body 9 mm., of the wings 17 mm.

The general pale coloration of the body, the black tomentum of the anterior part of the segments of the abdomen, and the black scales of the veins of the wings arranged in three spots are the distinguishing points of this species.

Habitat.—Mexico.

7. **CULEX FULVUS,** Wied.

Wings with a brownish black patch at the apex; tarsal joints with yellow apical bands; lanugo smooth; thorax not dorsally ornamented; palpi longer than the proboscis.

Description from Weid., "A. Z. I.," p. 546. Body black, with yellow hairs, and the hinder legs banded brown. Length two and a-half lines (German). ♀.—Antennæ brownish; proboscis and palpi (which latter are somewhat longer than is usual) golden yellow, with brownish black apices; ground colour of the body glistening brownish black, thickly beset with golden yellow hairs, those on the abdomen being somewhat lighter, and on the incisuræ abdominis blackish. Wings, golden yellow along the costa, and brownish black at the apices; legs golden yellow; in the front leg, the extreme apex of the femur, tibiæ, and foot-joints brownish black on top; the middle legs are missing, but the hinder legs have the femur and tibiæ also brownish black at the apex, while the foot-joints, on the contrary, are much brighter, and brownish black elsewhere; the basal half of the second foot joint also remains yellow.

Habitat.—Brazil.

8. **CULEX PENETRANS,** Desvoidy, (1827).

Wings with five more or less distinct spots; tarsi with yellow bands; lanugo smooth; thorax fulvous with two brown dorsal lines; palpi of the male filiform.

Description from "F. R.," p. 246.—In the ♂, the palpi are more filiform than in *C. annulatus;* the antennæ of the ♀ are yellowish brown; in the ♂, shorter and more plumose than in *C. annulatus;* thorax fulvous, with two brown dorsal lines; abdomen yellow, with brownish incisuræ; wings with yellowish scales, and with five more or less distinct spots; tarsi yellow, with brown rings; filiform, and pale yellowish in the ♂, with the third joint of the middle pair ciligerous. Length 3 lines.

Habitat.—France. This species has been noted by Desvoidy alone, and, in view of the great variability of *C. annulatus*, established by Ficalbi's researches, it seems probable that Desvoidy's specimens were only aberant individuals of that species.

9. **CULEX LANIGER,** Wied.

Wings limpid, the veins with alternate fuscous and white scales; their inner margin alternately banded fuscous and white; tarsal joints banded, and some joints wholly white; tomentum woolly; thorax with a median white line; abdomen white, with a fuscous apical band on each segment.

Description from Wiedemann, "D. E.", p. 9.—Entirely covered with woolly hairs, variegated with white and fuscous. Length 4 lines (German). ♀—Proboscis yellow, with a white band at the apex; palpi two-thirds the length of the proboscis, the middle joint longer than the apical, the third shortest, all covered with a white and intermixed fuscous lanugo; the bases of the antennæ yellow, the flagella whitish; head covered with fuscous lanugo, with a white middle line; thorax covered with fuscous lanugo, with a median stripe, and two continuous stripes on the pleuræ, white; abdomen white, with a fuscous band on the apex of each segment. Wings, limpid, the veins with fuscous and white scales, the internal margin ciliated alternately fuscous and white; halteres whitish. The ground colour of the legs is yellow, but is,

like the trunk, covered with white and fuscous lanugo; there is no white in the anterior tarsi, but in the hinder their apices are white; the tibiæ of the front legs are white alike at their bases and apices, while those of the middle and hinder are banded white; the femora of the front legs have three, and of the hinder and middle four white bands.

Both this species and *C. mucidus*, Karsch, belong, in all probability, not to *Culex*, but to the genus *Psorophora*. The point cannot however, be determined without the inspection of actual specimens. The same remark applies to *C. commovens*, Walker, in all probability, but here, the one remaining specimen of his type is too damaged to show the pro-thoracic processes.

Habitat.—Java.

10. **CULEX COMMOVENS**, Walker.

C. hispidosus, Skuse.—Wings varigated with patches of parti-coloured scales, alike on the veins and internal fringe; tarsi and abdomen yellowish brown with paler banding.

Walker's type of this species, which, as he notes, reached him in a mutilated condition, corresponds entirely with Skuse's description of *C. hispidosus* in all remaining recognisable points, so that I think there can be no doubt that the latter name is but a synonym for Walker's necessarily more than usually hazily described species. As a matter of form, I give Walker's description, but for purposes of recognition Skuse's excellent description should be followed.

Descriptions from Walker, "Ins. Saund. Dipt.," p. 432; and from Skuse, "S. A. C." p. 1726.

Walker.—Described from injured specimens. Brown, robust; proboscis long, stout, straight, testaceous, blackish towards the base above and at the tip; palpi testaceous, rather more than half the length of the proboscis. Antennæ testaceous, with very slender blackish bands, shorter than the antennæ; thorax striped (?); abdomen with tawny bands; legs tawny, stout; tips of femora, tibiæ, and tarsal joints brownish. Wings limpid; veins testaceous, with some

brownish marks. Length of the body 4 lines; of the wings 7 lines.

Habitat.—New Holland.

Skuse.—Male.—Length of antennæ 3·04 mm.; expanse of wings 6·09 × 1·13 mm.; size of body 7·62 × 1·13 mm. Antennæ pale ochre yellow, the verticils silky, almost hoary at the tip when viewed in a certain light; not quite two-thirds the length of the palpi; the joints of the scapus more or less covered with white scales; head adorned with a mixture of erect, yellow and white scales and long hairs; the eyes bordered with a compact line of white, decumbent scales; proboscis pale ochre-yellow, brown at the base and black at the end, about five-sixths the length of the palpi; palpi, pale ochre-yellow, imperfectly covered with white scales, the first two joints and the tips of the remaining joints with brown scales, hairs pale ochre-yellow, silky; sixth joint considerably longer than the fifth. Thorax densely covered with scales, some very long and almost erect, appearing grey to the naked eye, but under a lens proving to be chiefly white scales, variegated with indistinct longitudinal lines and patches of very pale yellow scales, the whole interspersed with long yellow hairs; a roundish patch of yellow scales under each humerus, a narrow, median, longitudinal stripe appearing only to reach the middle of the thorax, and lastly, a short lateral stripe, beginning opposite the termination of the median one underneath each humeral patch, and extending to the scutellum (in a certain light these short lateral stripes appear to form a fork with the median stripe); pleuræ ochre-brown, almost hoary, when viewed at a certain obliquity; halteres pale ochre-yellow. Abdomen, whitish, two and a-half times the length of the thorax, densely clothed with long white, decumbent and erect scales, and long yellow hairs; each segment bordered behind with a broad band of pale yellow, in the last two or three segments, apparently represented by two lateral patches; beneath covered with white, decumbent scales, the segments bordered behind with bi-coloured scales, the basal half of each being pale yellow, and the apical half umber-

brown; forceps densely covered with scales and long yellow hairs, basal joints brown, the terminal hooks yellow, very long and incurved. Legs pale ochre-yellow, densely covered with long, semi-erect scales, interspersed with long yellow hairs, making them appear more than twice their real thickness; coxæ ochre-brown, more or less covered with white scales; the remaining joints ringed with white and bi-coloured scales alternately, the colours of the latter as on the abdomen; the dark rings on the femora and tibiæ much wider than the white ones, both about equal width, or the latter somewhat wider on the tarsi. Wings about the length of the abdomen, hyaline, veins yellow, covered with white and similar bi-coloured scales; the marginal cilia grey and white patches alternately, rather weakly iridescent; auxiliary vein joining the costa opposite the tip of the posterior branch of the fifth longitudinal vein; sub-costal transverse, much nearer the origin of the second longitudinal than to the humeral transverse; middle, a little shorter than the posterior transverse vein, almost in a line with each other, placed over the middle of the posterior branch of the fifth longitudinal; both these cross-veins and the base of the second longitudinal slightly clouded with pale fuscous; anterior branch of the fifth longitudinal originating a little before the tip of the sixth longitudinal, and its tip joining the posterior border opposite the base of the second posterior cell, which latter is somewhat wider than the first submarginal cell, and half its length.

Habitat.—Hexham swamps near Newcastle and Richmond (Skuse); Mount Kembla, Illawara. N.S.W. (Mr. A. G. Hamilton), January, known as the "Hexham grey." By far the most beautiful and distinct of the Australian species of *Culex*. Is a day-flying bush mosquito. Skuse had not been able to obtain a female specimen.

11. **CULEX MUCIDUS,** Karsch.

Wings with variegated scales; those of the veins of the mid-field black, so as to form a dark patch in the middle,

the fringes of the posterior border alternately banded black and white; tarsal joints with basal white bands; tomentum long and woolly, so that the insect looked mildewed; thorax and abdomen yellowish brown, with a bright longitudinal band.

Description from Karsch, "Ent. Nachr.," 1887, p. 25.—Thickly clothed with a scaly tomentum, variegated white, yellow, yellowish-brown, and black, so that, at first sight, a specimen looks like a mildewed insect; anterior tarsi, clear yellow; middle and hind tarsi with the basal half white, and the apical yellow scaled. Length, 8·5 mm. ♀.

Head clothed with yellowish brown scales, with a bright white longitudinal stripe, clothed with clear white scales on the hinder part; proboscis and palpi variegated white, yellow, yellowish-brown and black, the former with long, yellowish-brown and black scales, particularly on the underside, the latter with the white scales preponderating, though intermixed with yellowish-brown scales; thorax and abdomen with yellowish-brown scales, a bright longitudinal stripe, and numerous speck-like clear white scaled spots, which sometimes coalesce, white; the small scutellum is entirely white scaled. Legs mainly covered with long yellowish-brown scales; amongst those forming the tomentum of the femora may be observed solitary black scales, and there are annular, bright white scaled markings on the base, apex and middle of these articulations; the anterior tibiæ with yellowish-brown, mingled with long solitary scattered black scales, narrow at the base, and bright white scaled at the apex; anterior tarsi with short clear yellow scales; middle and hind tibiæ, with long yellowish-brown scales, with a few scattered solitary white ones intermixed; the three middle joints of the middle and hind tarsi, with the basal half white, and the apical yellowish-brown scaled; wings with similarly variegated scales; the veins of the mid-field with black scales intermixed with white, the fringe of hairs on the posterior border banded black and white.

This is one of the species of *Diptera* collected by Frau Rosa Monteiro at Delagoa Bay, and is named from its wonderful resemblance to a mildewed insect. It a good

deal resembles a species of *Culex* numbered 5,398 in the Berlin Museum, but differs in the more heavily scaled armature of the legs.

Like *C. laniger*, this is also probably a *Psorophora*.

Habitat.—Delagoa Bay.

12. **CULEX GLAPHYROPTERUS,** Schiner (1864.)

Wings with black spots formed of accumulations of scales, arranged as in *C. annulatus;* tarsi dark brown, without bands; thorax indistinctly ornamented; abdominal segments nearly black, with white basal bands.

Description from "F. R.," p. 247.—Antennæ brown with the rotund basal joint yellow, and the plume brown; nape with deep grey or brassy tomentum; thorax generally brownish yellow on the dorsum, with brassy or golden tomentum, usually four dark longitudinal lines can be made out; pleuræ ferruginous. Wings densely brown-scaled, accumulations of these determine the position of the spots in exactly the same situations as in *C. annulatus;* hips and the roots of the coxæ yellowish; knees pure yellow; tarsi black or nearly so. Abdominal segments nearly black, with a whitish anterior band, the last segment with most white; abdominal tomentum very long, but not distinctive. Length of the body 9 mm.

Habitat.—Described by Schiner alone from Austria.

A very elaborate supplementary description of this species is given in Ficalbi's "Venti Specie di Zanzare, 1899." In this the ♂ palpi are said to be moderately clubbed at the end, brownish-black, rather lighter at the base but without adornment; those of the ♀ are brownish black, with a short conical fourth joint. The indistinct thoracic adornment consists of a median, two lateral and border lines of golden yellow on a maroon brown ground.

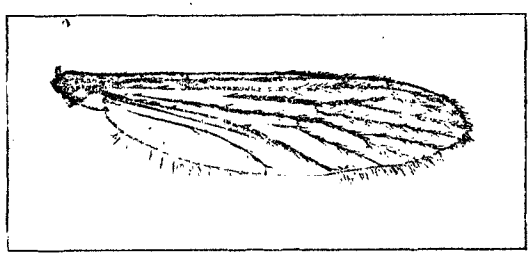
C.—Species in which the Wings are Unspotted.

13. **CULEX TÆNIATUS,** Meigen.

C. elegans, Ficalbi (1889), *C. Rossii,* Giles (1899), "Jour. Trop. Medicine," p. 64.—Wings unspotted; joints of the

tarsi with basal snow-white rings; thorax brown with a pair of submedian snow-white lines, forming a V behind, and two lateral semilunar patches, prolonged posteriorly into fine lines of the same; abdominal segments with basal white bands, best marked in front; nape with six silvery lines.

Mr. E. E. Austen, from the examination of a very large series of specimens has come to the conclusion that as Wiedemann's description was drawn up from a rubbed specimen, and no one seems to have met with further specimens exactly conforming to his definition, while one of the commonest of Mosquitoes agrees absolutely in all particulars saving only the thorax, a region that quite rarely retains all its markings in pinned specimens, the original description of the thorax is erroneous. It was owing



Wing of Culex tæniatus from India.

to this discrepancy in the described and actual thorax that I was led to look upon some specimens from India as a distinct species, which I named *C. Rossii*, and I have no doubt that similar reasons led to the institution of Ficalbi's *C. elegans*, the excellent description of which corresponds with the specimens of Mr. Austen's series to the minutest detail, and I now entirely agree with Mr. Austen that both Ficalbi's and my own species are but synonyms of Wiedemann's.

The species appears to be most truly cosmopolitan, as in addition to the Italian and Indian examples above-mentioned, Mr. Austen has collected specimens from both America and Africa. Apparently, however, it is not to be met with in the colder parts of the globe.

The type in the Jardin des Plantes has the abdomen missing. The wings have the stem of first sub-marginal shorter than that of the second posterior cell, but the former is longer and narrower. The second, third and fourth longitudinal veins are gathered very close together opposite the transverse veins; while the posterior transverse is also very short and placed more than its own length internal to the middle transverse; the fork of the fifth longitudinal is also narrower than usual, and the wing as a whole is narrow.

Under the circumstances, it appears best to supply both descriptions, *viz.*, from Wiedemann and Ficalbi.

Description from Wied., "A. Z. I." p. 10.—Fuscous; with two stripes on the thorax; the abdomen banded; with yellow legs; $1\frac{1}{2}$-$1\frac{3}{4}$ lines ♂, Savannah. Antennæ brownish, snow-white at the point of insertion on the frons; palpi of the males with four white bands, of the females white only at the root and tip; frons snow-white; proboscis brown, without any bands; the denuded thorax of the males brown, of the undenuded females brownish, with three brown stripes, the middle one of which is linear and smaller, the suture snow-white on either side; the scutellum glistening white; pleuræ brownish, with snow-white puncta. The denuded abdomen of the males brown with yellowish-white incisuræ; here and there may be observed a snow-white scale; the female has on the brown abdomen a clear yellowish-white incisura, and on either side of every segment a distinct triangular snow-white spot. Wings transparent with brown scales; legs brownish black; the bases of the femora bright yellowish; knee snow-white; in the front legs the bases of the first and second joints, and in the hind legs, the bases of all the joints, and the whole of the fifth joint snow-white.

Wiedemann suggests that this may be no more than a variety of *C.* fasciatus, Fabr., which, however, seems improbable, as Fabricius's species has three white bands on proboscis.

Description from Ficalbi, "F. R.," p. 251.—Proboscis black in the ♂; dark brown in the ♀; palpi of the ♂ barely

longer than the proboscis, almost naked, black, with four sharply defined silvery rings; of the ♀ black, with the last joint and a spot on the penultimate, white. Antennæ dark brown, with the basal joint elegantly marked with silver-white in both sexes; clipeus black, with two converging silvery marks, especially clear in the ♀; eyes dark metallic green, with a silvery border. The nape is dark brown and, besides the border of the eyes, is marked with six silvery lines, two median uniting in front and continued over the head between the eyes, and two lateral on either side, the lower being almost ventral. Thorax with the dorsum generally dark brown ornamented white as below; first there are two fine parallel median lines on its anterior three-fourths, and across the posterior end of these a V-shaped mark with the apex forwards; secondly there is a semilunar mark, with the concavity backwards, on the fore part on either side, and its posterior extremity (which just reaches to the mid-length of the thorax) prolonged into a fine, slightly diverging interrupted line to the hinder border of the thorax; there is a further small mark, placed vertically, immediately in front of the root of the wing; and lastly, there are four spots along the posterior border, two of which are in front of the scutellum. Pleuræ brown with silvery spots; venter of the thorax with two linear marks opposite the attachment of the anterior coxæ; halteres dusky with bright yellow stems. Wings fuliginous; fourchettes with their branches rather longer than their respective stems, which latter are of approximately equal length. Legs: coxæ dusky, with an external white streak; femora with their proximal third and a minute apical ring white, the rest black; tibiæ entirely black; tarsi black, with the first two joints of all three pairs basally white-ringed, and the hind legs with additional rings on the third and fourth joints, and the fifth entirely white, the ring on the fourth joint occupying two-thirds of its length. Abdomen in the ♂, moderately fringed with bright yellow hairs; dorsally dark brown in front, black behind; the bases of, from the third (or sometimes the second) to the sixth segments with transverse white marks, not amounting to complete bands,

brightest in front and progressively less marked behind; the sides of all the segments with white spots which are larger and more dorsally placed on the last segment; venter yellowish in front, darkening to deep brown behind, with a basal transverse, white line on the fourth, fifth and sixth, and often on the seventh and eighth segments, most distinct on the fourth; laterally darker with six very small white spots. In the ♀, the abdomen is generally somewhat darker but, in addition to the transverse basal bands confined in her to the fourth and sixth, or occasionally to third and seventh segments, every segment has the hinder border bordered white; and she has five silvery lateral spots more or less bounded by brownish-black. Length variable; including the proboscis 4½-7 mm. in the ♂, and 7-8½ mm. in the ♀.

Ficalbi seems in doubt if this is not identical with *C. calopus*, Meig., but concludes to separate it on the ground that the latter states the dorsum of the thorax to be marked with dark lines. As, however, Meigen expressly states that his specimen was in bad condition, and the white scales on which the difference of Ficalbi's species depends would be most easily rubbed off, it appears more probable *C. calopus* is also only a synonym for *C. tæniatus*.

Habitat.—Italy and the Mediterranean islands. It bites viciously and causes great irritation of the skin, and the species is peculiar in the fact that the males bite as persistently as the females. It is a diurnal species.

14. **CULEX BANCROFTII,** Skuse (1889).

Tarsi with snow-white basal bands. Thorax dark brown with two submedian longitudinal lines ending in a spade-shaped expansion, and two lateral curved lines of snow-white; abdomen violet black with white basal bands to the segments; a small silvery patch on each side of the head.

Description from "S. A. C.," p. 1,740. ♂—Length of antennæ 1·66 mm.; expanse of wings 2·54 × 0·58 mm.; size of body 3·55 × 0·76 mm.

Antennæ very dark brown, the verticils black, about three-fourths the length of the palpi; first joint of the

scapus black with silvery scales. Head (when denuded) almost black, clothed with violet black scales, with a very small patch of silvery scales on each side, some whitish scales in the middle, and a silvery line bordering the eyes. Proboscis violet-black, as long as the palpi; palpi violet-black, the four joints basally white-ringed, the first two rings being much the broader. Thorax very dark brown (when denuded), brown-scaled, with some brown hairs interspersed and traversed by four silvery, longitudinal lines

the two middle ones straight, parallel, and very fine, ending at a bare patch in front of the scutellum, and an outer pair stouter and sinuous, broader in front, the whole arranged as shown in the text; pleuræ very dark brown with numerous small, brilliant, silver-scaled patches; scutellum very dark brown, silver-scaled above and fringed with long brown hairs; halteres ochreous. Abdomen a little more than twice the length of the thorax, densely violet-black scaled, second to sixth segments white-banded in front, those on the last three short, not reaching the borders, each segment with a small, brilliant, silvery-scaled patch at the sides; venter clothed with yellowish and violet-black scales, the latter predominating; holding forceps very dark brown, densely haired. Coxæ brown with silvery scales; rest of leg joints violet-black scaled; femora with white scales along the sides, nearly to the tip, and beneath on the basal half, the apex silver-white; the first two joints of the fore and middle tarsi, and all the hind tarsal joints, basally silver-ringed; hind tibiæ about one-third longer than the metatarsus. Wings about as long as the abdomen, hyaline, veins violet-brown scaled; auxiliary reaching the costa opposite the cross-veins and much before the tip of the hinder branch of the fifth longitudinal; middle shorter than the posterior transverse vein, and placed a little more than the length of the latter beyond it; first sub-marginal considerably longer and slightly narrower than the second posterior cell, their bases opposite; anterior branch of fifth longitudinal as in *C. flavifrons*, &c. May not this also be *C. tæniatus?*

Habitat.—Brisbane, December.

15. **CULEX ALBOANNULATUS,** Macquart (1850).

Macquart, "D. E.," 4th Suppl., p. 10.

Wings unspotted; most of the tarsal joints with basal white bands; thorax red-brown with five bare lines rendered more prominent by white scales; abdomen dark olive with basal white bands; head brown with golden and white scales, and generally brown and white lateral patches.

Description from "S. A. C.," p. 1,732. Male.—Length of antennæ, 2·02 mm.; expanse of wings, 0·18 × 0·88 mm.; size of body, 5·33 × 0·88 mm. Female. — Length of antennæ, 2·14 mm.; expanse of wings, 4·31 × 1·01 mm.; size of body, 5·33 × 1·01 mm.

♂ and ♀.— Antennæ in the ♂ brown, the hairs pale brown; sericeous a little more than two-thirds the length of the palpi; the first joint of the scapus black; in the ♀ dusky brown, three-quarters the length of the proboscis, the scapus testaceous. Head brown, more or less covered with golden and white scales, sometimes with patches of brown, generally with a small patch of white on each side; sparingly pilose. Proboscis in the ♂ somewhat longer than in the ♀, six times the length of her palpi, generally very dark coloured, sometimes a little yellowish beneath in the middle. Palpi dark; in the ♂, the last four joints white-ringed basally; in the ♀, the fourth slightly so ringed and the minute end joint wholly white. Ground colour of thorax deep red-brown, densely brown-gold-scaled marked by five indistinct bare lines, which are made somewhat more prominent by white scales which give the thorax a silky appearance; these consist of a median mark, spade-shaped behind, and four others arranged as diagramatically shown in the text. These lines are, in places, slightly bordered white, and the spatulate enlargement of the median, is marked with four tiny patches of white scales; pleuræ fuscous-red marbled with patches of white scales; some brown hairs about the origin of the wings; scutellum dark red-brown, adorned with three patches of white scales and fringed

with long brown hairs; metanotum brown; halteres dark brown, the stem often entirely testaceous. Abdomen in the ♀ about twice the length of the thorax, proportionately somewhat longer in the ♂, dark olivaceous; in the ♂ with each segment narrowly bordered white in front, less distinctly so in the female, which generally has a distinct white spot laterally on each; the segments densely fringed behind, and laterally with pale yellowish hairs more dense and stiff in the ♂ than in the ♀, particularly at the sides; venter more or less white-scaled; forceps of ♂ and lamellæ of ♀ deep brown; coxæ fuscous with white scales and pale yellow hairs; ♂ femora violet-black scaled, somewhat whitish spotted, especially at the base and beneath, and slightly so apically; in the ♀ usually pale for two-thirds their length, the rest violet-black, and more or less so along the upper side, usually with a distinct ring of white before the end, the tip and genu always whitish. Tibiæ and tarsi violet-black or brown, the former fringed with erect hairs, the latter in the fore and middle legs with the first three joints slightly basally white-ringed in the hind legs, the first four, and in the ♀, sometimes all the joints, with a broad basal white ring. In the hind legs the tibiæ about one-fifth longer than the metatarsi. Wings, in the ♂ the length of the abdomen, in the ♀ longer and wider; hyaline, the veins clothed with dark brown scales, cilia greyish. Auxiliary vein reaching the costa opposite the tip of the hinder branch of the fifth longitudinal; middle rather longer than the posterior transverse, placed beyond the latter a distance equal to its length; first sub-marginal rather longer and much narrower than the second posterior cell, its base lying somewhat beyond that of the latter; anterior branch of fifth longitudinal, as in *C. vigilax*.

This species is somewhat variable, and approaches *C. annulatus;* occasionally the proboscis is slightly curved, but this is a not uncommon anomaly in other species.

Habitat. — New Holland, eastern coast (Macquart); Sydney (Thomson), common, also Worona and Blue Mountains, N.S.W. (Masters and Skuse). October to January.

16. **CULEX MOSQUITO,** Desvoidy.

C. frater, Desv. Wings unspotted; tarsal joints (of fore legs) basally banded white; thorax dark coloured? with silvery puncta and large silvery lateral semilunar marks; abdomen black with silvery incisuræ; bases of femora pale.

I assume the bands of the tarsal joints to be basal because Williston makes this species a synonym of *C. fasciatus* (Fabr.), but this identification can hardly be correct because no lighter abdominal bands are mentioned in either Fabricius's or Wiedemann's descriptions.

Description from Desv. "Essai," p. 407.—Proboscis black; palpi white banded; head and thorax with silvery spots and the latter with semilunar silvery dorsal spots; abdomen with silvery incisuræ. Length 2 lines.

♂.—Antennæ and proboscis black; palpi black with white bands; head black with silvery specks; thorax with silvery spots and lateral semilunar silvery spots; abdomen white with silvery incisuræ above; femora with their bases pale; feet black; joints of the fore tarsi with broad silvery bands; wings pellucid, limpid, their veins not very hairy; the internal margins fringed.

Habitat.—The island of Cuba; very troublesome in the rainy season, and named Mosquito by the natives. Also recorded as North American in Osten-Sacken's Catalog.

17. **CULEX SCUTELLARIS,** Walker (1859).

Wings unspotted; tarsi with basal white bands; thorax dark brown with a median and two lateral, snow-white stripes; abdomen with silvery bands; scutellum reddish.

Description from Walker, "Journ. Proc. Linn. Soc.," III. (1859) p. 77.

Male.—Blackish brown; head and thorax with three silvery stripes, the middle ones very distinct; scutellum reddish; pectus with silvery gloss; abdomen with silvery bands, which are narrow above, broad beneath; femora

pale toward the base; knees snow-white; hind tarsi with five snow-white bands; middle tarsi with the first and second joints white at the base; wings slightly greyish; veins black, fringed. Length of the body 3 lines; of the wings 5 lines.

This is a very well marked species. In the type in the British Museum the lateral snowy stripes of the thorax are broad and are widely separated from the very narrow median stripe. The transverse veins are placed unusually near the apex of the wing so that both the fork-cells are very small.

Habitat.—The Celebes.

18. **CULEX NOTOSCRIPTUS,** Skuse (1889).

Wings unspotted; tarsi with basal white bands; thorax deep umber brown, elaborately ornamented with straight and curved silvery lines; abdomen violet-black with basal ochreous bands.

Description from "S.A.C.," p. 1738.—Length of antennæ ♂ 1·77 mm.; ♀ 2·14 mm.; expanse of wings ♂ 3·55 × 0·76 mm.; ♀ 4·06 × 1·01 mm.; size of body ♂ 4·06 × 0·76 mm.; ♀ 5·56 × 0·88 mm.

♂ Antennæ light brown, with greyish, silky verticils about seven-eighths the length of the palpi; first joint of the scapus with a small internal patch of silvery scales. Eyes olive-green, bordered behind with a fine line of white scales, followed by a broad band of violet-black, behind which is a patch of yellow scales; proboscis as long as the palpi, dark violet, with a moderately broad band of white just beyond the middle; palpi brown, violet-black towards the apex, the last two joints basally ringed white. Thorax deep umber-brown, with a dense minute black pubescence, and marked with several fine more or less longitudinal lines, silvery white, except the two short anterior ones which are sometimes golden, arranged as shown in the text; pleuræ, scutellum and metanotum paler brown than the rest of the thorax, the first with (generally eleven) small patches of silvery scales;

scutellum bordered with a broad line of silvery scales, interrupted a short distance from each extremity; the interstices of the thoracic lines and the scutellum beset with long black hairs; halteres pale, with some white scales. Abdomen twice the length of the thorax, dark violet, each segment bordered in front with ochreous scales, and with a small lateral patch of silvery scales; long golden hairs; beneath dark violet, each segment slightly silver-banded in front, and the short terminal segment silvery-scaled; holding forceps deep brown; coxæ yellowish, with silvery scales and golden hairs; remaining joints violet-black, with a silvery line along each side of the femora and tibiæ, and a basal silvery ring to all the hind tarsal joints and on the first two tarsal joints of the other legs. Wings about the length of the abdomen, barely brownish, veins densely brown-scaled, cilia silky, grey, brilliant violet and purple reflections in certain lights; auxiliary vein joining the costa a little before the tip of hinder branch of fifth longitudinal; middle and posterior transverse veins of equal length, the former placed twice its length in front of the latter, which is placed opposite the middle of the hinder branch of the fifth longitudinal; first sub-marginal longer and narrower than the second posterior cell, their bases lying opposite each other; anterior branch of fifth longitudinal as in *C. annulirostris* and *C. notoscriptus*.

Very common, occasionally coming into the house in the day. Causing more irritation than any other Sydney species. A small variety is common in the Blue Mountains. From December to March their larvæ and pupæ swarm in waterbutts and garden tanks. In hot weather the larvæ are hatched from the boat-shaped masses (each containing some 300 eggs) in about twenty-four hours, and the perfect insect emerges in from three weeks to a month.

Habitat.—Sydney, generally distributed in N.S.W., September to January.

19. **CULEX CANTANS**, Meigen.

C. fumipennis, Stephens, "F. R.," p. 259.—Wings unspotted; tarsi black with basal white bands; thorax red-brown

with two faint brown lines, limited with brilliant white tomentum; abdomen dark brown with yellowish basal bands.

Description from "F. R.," p. 258; *C. maculatus*, Meig, 1818.—Proboscis yellowish, more or less brown, blackish at the end; palpi of the ♀ brown-black, spotted with white; of the ♂ somewhat pencilled with annular yellowish marks on the middle joints, and armed with a fuscous brush, with brilliant yellow reflections. Schiner describes the brush in the ♀ as yellowish. Thorax dorsally red-brown with two faint brown lines, limited with brilliant white tomentum; pleuræ generally brownish, speckled yellowish, and with white marks opposite the coxæ; scutellum yellowish-white; wings yellowish-brown; halteres pale yellow; legs with the hips yellow, and the coxæ yellow at the base and beneath, browner distally, and quite brown above; knees mere yellowish points; tibiæ brownish, blackish at the end; first tarsal joint brownish, distally nearly black for some length, with a small yellowish basal ring; the other joints brown, with broad basal yellowish rings, except the last, which is narrow. Abdomen with yellowish tomentum laterally; dorsally very dark brown, with basal yellowish bands on the segments expanding backwards somewhat laterally; forceps of the ♂ very long. Total length over 9 mm.

Habitat.—Meigen described this species from Germany (in groves); Schiner notes it from Austria; Stephens and Waker from England; Zetterstedt from Lapland and Scandinavia; Siebke from Norway; Gimmerthal from Russia. Ficalbi has not found it in Italy, but describes it from a ♂ (10-11 mm. long) obtained from Germany.

I have seen the type in the Jardin des Plantes. The description of the thorax is hard to follow. In its present state the ♂ shows simply a thick brownish white tomentum, with a marbling of the red-brown ground seen through it, in the ♀ it is red-brown with two slight, lighter marks. In the ♂ the abdominal bands are basal and clear, less so and more yellowish in the ♀. Wings with brown scales, except on the internal fringe, which is white, especially brilliant in the ♂. The supernumerary and middle transverse veins are in one line, the posterior transverse being placed a little

internal to them. The stem of the anterior fork-cell is a trifle shorter than that of the posterior, the anterior cell being much longer and narrower.

The very incompletely described species, *C. conterrens*, Walker, and *C. Caspius*, Pallas, would find their places here, assuming the light banding of the tarsal joints to be basal.

20. **CULEX VITTATUS**, Bigot (1861).

Wings unspotted; tarsi with snow-white basal bands; thorax brown, with white marks on the dorsum and pleuræ; abdominal segments with apical white borders.

Description from "F. R.," p. 257.—Palpi of the ♀ with the ends white; basal joint of antennæ adorned with a white spot; a white spot on the frons and another on the hinder border of the orbit; thorax brown, with white marks, which are present also on the pleuræ; wings grey; halteres with a blackish club; legs generally black; hips black, with a white ring, coxæ with two broader bands, one at the base, the other at the apex: knees, tibiæ towards the middle, and the bases of the tarsal joints adorned with white rings, five on the hinder, and three on the middle and fore legs abdomen with the segments brown in front and darker behind, except a posterior bordering of snow-white; on the venter the white hinder border is more ample. A small species, being only 5 mm. long.

Habitat.—Described from Corsica by Bigot. Has been noticed by no other author, and seems suspiciously like *C. calopus*, Meig.

Note.—Near this species is *C. aureostriatus*, Doleschall, which, however, cannot be definitely placed here owing to our being left in doubt as to the position of the tarsal banding.

21. **CULEX ALBOPICTUS**, Skuse.

Wings unspotted; tarsal joints banded white; on the first two of the fore and middle, and on all those of the

hind legs; dorsum of thorax traversed by a line of silvery scales for rather more than its anterior half; the pleuræ silvery spotted; abdominal segments narrowly banded silvery, and with lateral silvery spots: femora slightly tipped silvery.

Description from F. A. A. Skuse, "Indian Museum Notes," III., 5, p. 20.—Length of antennæ 1·50 mm.; of body 3-3·50 mm.; expanse of wings 2·50 × 0·50 mm.

Black with silvery-white markings. Antennæ somewhat shorter than the proboscis; joints of the scapus with silvery scales; head with silvery scales on the front and sides; proboscis five times the length of the palpi, the latter tipped with silvery scales; thorax transversed by a line of silvery scales for rather more than its anterior half; pleuræ spotted with silvery white; scutellum with minute silvery hairs; abdomen twice the length of the thorax, the segments bordered with a narrow band of silvery scales and with lateral silvery spots. Legs; femora with a silvery line beneath and slightly tipped with silvery scales; tarsi, the two first joints in the fore and middle legs with a narrow silvery ring at the base; broad rings at the bases of all the hind tarsal joints, the last joint entirely white; in the hind legs, the tibia about one-third longer than the first tarsal joint. Wings the length of the abdomen, pellucid, iridescent, the veins clothed with linear black scales, auxiliary vein joining the costa at a point a little before the posterior branch of the fifth longitudinal; middle cross-vein indistinct, shorter than the posterior, placed beyond it scarcely a distance equal to twice the length of the latter; first sub marginal, longer and narrower than the second posterior cell, their bases opposite or nearly so; the anterior branch of the fifth longitudinal originates about midway between the origin of the second longitudinal and the tip of the sixth longitudinal vein.

A great nuisance in Calcutta.

Allied to *C. notoscriptus* and *C. Bancroftii*, but the thorax is less elaborately ornamented.

It is probably to this species that Lewis refers under the name of *C. mosquito* in his paper on filariasis in the "Proc. Asiatic Soc., Bengal," 1878, pp. 89-93.

A specimen kindly sent me by Captain Victor Lindesay from Bakloh in the Punjab, agrees well with this species, though the ornamentation of the thorax is absolutely identical with that of *C. nòtoscriptus*, Skuse; but it is quite possible that Skuse's specimen may have been too rubbed to enable him to describe this region correctly, and the wing agrees much better with that of the present species. In this specimen the broad basal bands of the tarsal joints involve slightly the apex of the contiguous joint, but this might easily be overlooked; and it is possible that it may be distinct.

22. **CULEX EXAGITANS**, Walker.

Wings unspotted; tarsal joints with basal white bands; thorax brown with two slender whitish stripes; abdominal segments testaceous, with whitish basal bands and a row of silvery dots on the sides; proboscis curved. General coloration dark brown.

Description from "Insecta Saundersiana," p. 430.—♀—Brown with white spangles. Proboscis slender, curved, partly testaceous; palpi black with silver-white tips; thorax with two slender whitish stripes. Abdomen mostly testaceous on the disc, with a whitish band at the base of each segment, and a row of silvery dots along the sides. Legs very slender; femora testaceous with brown tips; knees silvery white; tarsi with silvery white bands. Wings greyish; veins brown, fringed with long hairs; halteres testaceous. Length of the body 2½ lines; of the wings 4 lines.

This species is evidently very close to the preceding. It differs mainly in the brick-red coloration.

In Walker's type the wings have the anterior fork-cell as broad as, but much longer than the posterior, both cells being narrow, with parallel sides. The stem of the anterior fork is greatly shorter than that of the posterior. The posterior transverse vein is placed more than twice its length internal to the middle transverse. The bands of the tarsal joints are basal in position.

Habitat. — Para, South America. Much resembles *C. toxorhynchus,* but the latter has neither the white stripes on the thorax nor the dots on the sides of the abdomen.

23. **CULEX SUGENS,** Wied.

Wings unspotted; tarsi with basal white bands; thorax yellowish-brown, with two white spots in front and a white line on its edge, in front of the scutellum, as well as deeper brown longitudinal lines; abdomen brown with snow-white incisuræ, and a white spot on either side.

Description from "Wied. Zweiflug. Insect.," p. 545.—Brownish; the thorax and abdomen with lateral spots, and the feet with bands of snow-white. Length, barely 2 lines (German) ♀.

Head, antennæ, and proboscis brown; the head with scattered white scales; thorax, a silky lustrous yellowish-brown, with deeper brown longitudinal lines on its sides; in front are two snow-white points, or rather spots; also, between the edge and scutellum a similar line, and on the pleuræ more such spots. Incisuræ abdominis, yellowish, and the segments with a snow-white spot on either side. The fore foot with two, and the hinder with five snow-white bands, namely one at the base of each joint of the foot; knee-joints of all the legs somewhat whitish; veins of the wings with brown scales.

Habitat.—Nubia.

24. **CULEX KOUNOUPI,** Brullé (1832).

Wings unspotted; tarsi with basal snow-white bands; thorax dark red with the pleuræ paler, and both adorned with silvery marks; abdomen not dorsally banded but with white lateral spots; its hinder half pale rose-colour.

Description from "F. R.," p. 256.—Head generally black, with the end of the palpi, basal joint of the antennæ, con-

tours of the eyes and the nape adorned with silvery white stripes and spots; thorax dark red with the pleuræ paler; and both adorned with silvery marks. Legs generally dark brown; coxæ rather yellow at the base, and silver-haired distally; tarsi with a broad silvery ring at the base of their joints; abdomen blackish at the base, and pale red on its hinder half, and on the hinder border of the anterior segments. Laterally each segment exhibits a silvery spot, and the first two have a dorsal white spot in addition. Length 5 mm.

Assuming the banding of the tarsal joints to be basally lighter, Walker's *C. formosus* (No. 78) would find its place after the above species.

Habitat.—Brullé describes his species from the Morea, and states that it is very numerous and troublesome near fresh water pools, but it does not appear to have been obtained by any other worker.

25. **CULEX VIRIDIFRONS,** Walker.

Wings unspotted; tarsal joints with pale basal bands; thorax brown (?) with three grey stripes; abdomen unbanded, but pale, with a brown stripe interrupted by white dots on either side; frons greenish.

Description from Walker, "List.," p. 3.—Head and thorax brown; clothed with yellow hairs and adorned with silvery spangles; frons green; thorax with three grey stripes; abdomen pale tawny brown towards the tip, and having a brown line along each side where it is adorned with large white spots; proboscis tawny. Antennæ and palpi brown; legs tawny; tips of the femora brown; knees white; tarsi with alternate rings of white, tawny and brown; wings colourless; veins brown, much fringed; halteres yellow with brown knobs. Length of the body 2 lines; of the wings $3\frac{1}{2}$ lines.

In Walker's type the banding of the tarsal joints is basal. The markings of the thorax and abdomen are obliterated, but some of the segments seem to have a fine

white fringe on their hinder borders. The wing has the anterior fork-cell long and narrow, the posterior broad and triangular with widely diverging branches.

Habitat.—Unknown, collected by Captain Lord Byron.

26. **CULEX TITILANS**, Walker.

Tæniorhynchus fasciolatus, Arribálzaga, "L. A.," p. 50 ?. Wings unspotted; tarsal joints with basal white bands; thorax dark brown, adornment not stated; abdomen unbanded, but with a white spot on either side of the fore border; proboscis with a "dull yellow band across it."

The description of the abdomen corresponds so well with Arribálzaga's species, the full description of which is given below, that there appears little doubt of their identity. Walker's specimens being not fresh, the multiple banding of the proboscis might easily be missed, and the same remark applies to the not particularly striking adornment of the thorax. For this reason I have placed the species amongst those with decorated thoraces, as the reader will thereby stand the better chance of being guided to the right description.

Description from Walker, "List," p. 5.—♀—Body dark brown. Antennæ black, each joint white at its base; proboscis black, with a dull yellow band across it; abdomen with a white spot on the fore border of each segment; legs brown; femora paler towards the base; knees yellow; tarsi with a white band at the base of each joint. Wings slightly brown; vein brown; halteres yellow with brown knobs. Length of the body 2 lines; of the wings 4 lines.

Habitat.—Brazil.

The type in the British Museum closely resembles certain specimens in the British Museum of *C. tæniorhynchus*. In both, the hinder fork-cell is broad and triangular with its stem lying very close to the third longitudinal. The body of the type is too rubbed to retain its markings.

27. **CULEX FASCIOLATUS** (Arribálzaga), (1891).

Wings unspotted; tarsi with snowy basal bands; thorax pitch brown with a broad median, brick-red line; abdomen dark steel-blue with the hind and lateral borders of the segments rather lighter, but not amounting to bands, and a series of silvery spots on either side; proboscis with three white bands.

Probably a synonym of *C. titilans*, Walker, but I give both descriptions separately, and indeed it is very likely that both Walker's and Arribálzaga's species are no more than synonyms *of C. fasciatus*, Fabr.

Description from "L. A.," p. 50.—*Tæniorhynchus fasciolatus*, Arribálzaga, *l. c.* ♀—Antennæ nearly black, more or less whitish at the articulations, with long, sparse verticils of the same tint and the basal joint brick-red; head nearly black, with silvery scales behind and sparse dusky hairs. Eyes dark green with a very narrow marginal silvery border; palpi dusky with their tips silvery; proboscis nearly black, with the tip white, a broad band of the same about the middle and a less obvious one at the base; thorax dark pitch-brown above with a broad median testaceous line clothed with reddish-golden scales, broader near the scutellum and with fuscous, rather long hairs above on either side; scutellum densely reddish-golden scaled without any visible setæ; pleuræ pitch-brown with frosty grey tomentum. Wings hyaline, very densely fuscous-scaled, the second posterior cell nearly a third shorter than the first. Halteres yellowish. Coxæ reddish; trochanters dull reddish yellow with frosty tomentum; femora black, yellowish beneath towards the base, adorned just above the apex with a snowy ring; knees marked with a white spot; tibiæ black with silvery specks, and the apex white. Abdomen dark steel-blue above, with slightly paler hinder and lateral margins, with a single row of silvery spots on either side, beneath brownish steel-colour with white hinder margins to the segments. Length, without the proboscis, 5 mm.

Habitat.—Navarro in Argentina.

The more natural position of this species is with the other members of Arribálzaga's genus *Tæniorhynchus* after *C. confinnis*, No. 37.

28. **CULEX FASCIATUS**, Fabr.

Wings unspotted; tarsi with basal white bands (on some of the joints); thorax black with a white dorsal line; abdomen unadorned; proboscis with three white bands.

Williston makes this a synonym of *C. mosquito*, Desv., but not, it appears to me, on sufficient grounds; on the other hand, it may very probably be synonymous with the preceding species, the abdominal adornment of the older types having possibly been rubbed and so overlooked. If this be so Arribálzaga's species cannot of course stand.

Description from Wied., "A.Z.I.," p. 8. Fuscous; the palpi and tarsi snow-white banded; 2 lines (German) ♂. From the West Indies.

Fabr., "Syst. Antl." 36, 13; *C. fasciatus*. Black, with the haustellum and front tarsi banded white. Of the size of *C. pipiens;* head black, with porrect haustellum, bearing three snow-white bands; thorax black, with a white dorsal line; abdomen dark coloured; wings spotless white; legs black, the front tarsi with three white bands; head brown; the protuberances, from which the antennæ spring, glistening snow-white (the antennæ themselves are wanting in the specimen); proboscis brown throughout; the extreme bases of the joints of the palpi white. The thorax is transfixed by too thick a pin, but shows a lighter stripe, which appears snow-white in certain lights; pleuræ brown, with a single glistening snow-white spot; abdomen lighter brown; wings transparent with brown-scaled veins; legs brown, showing yellowish in certain directions; the extreme base of the first joint of the front tarsi white. The hind legs are missing.

Noted as found in the island of Porto Rico, with the synonym *C. mosquito*, Rob. Desvoidy, by V. von Röder, in "Stetin. Ento. Zeitung," 1885, p. 338.

29. **CULEX VITTIGER,** Skuse (1889).

Wings unspotted; tarsi with very broad basal yellow lines; thorax black, with five equidistant, whitish vittæ beset with yellowish hairs behind; abdomen uniformly whitish, terminated by two small brown elongated lamellæ; proboscis ochreous in the middle, darker at base and apex.

Description from "S.A.C.," p. 726. Female.—Length of antennæ 2·54 mm.; expanse of wings 5·58 × 1.27 mm.; size of body 6·09 × 1·13 mm. Antennæ brown, nearly five-sevenths the length of the proboscis; first joint of the scapus and basal half of the second ochraceous; head densely clothed with yellow scales and hairs; proboscis brown at the base, ochraceous towards the middle, dusky towards the tip, rather more than four times the length of the palpi; palpi ochraceous, tip of the fifth and last joint dusky, densely covered with long hairs. Thorax black with five vittæ of whitish scales, the median one furcates a short distance before the scutellum, its branches coalesce with the next lateral vittæ; all the vittæ are equidistant and all beset with long golden-yellow hairs behind; the outside ones on the lateral margin rather wider than the rest, joining the next before reaching the anterior margin; pleuræ with some large patches of white scales; scutellum densely covered with white hairs and long yellow hairs; halteres yellow. Abdomen twice the length of the thorax, densely clothed with whitish scales, terminated by two elongate, deep brown small lamellæ; legs rather robust; coxæ brown, with white scales; femora, tibia and tarsi pale ochre-yellow, every joint tipped with black. Wings hyaline, veins yellowish-brown, cilia pale, sericeous; brilliant margaritaceous reflections. Auxiliary vein joining the costa before the tip of the fifth longitudinal vein's anterior branch; sub-costal transverse placed nearer the base of the second longitudinal than to the humeral transverse; middle considerably longer than the posterior transverse vein, the former placed a little in advance of the latter, both very little before the tip of the

posterior branch of the fifth longitudinal; anterior branch of the latter originating a little before the tip of the sixth longitudinal, and joining the margin opposite the base of the second posterior cell.

Habitat.—Port Denison and Wide Bay, Queensland (Masters); Gosford, N.S.W. (Skuse). February. Probably occupying the brush country all along the East coast.

30. **CULEX CALOPUS,** Meigen.

Wings unspotted; tarsi with broad basal white bands; thorax grey with four longitudinal brown lines; abdomen brown with silvery basal bands to the abdominal segments, and silvery lateral spots; abdomen black at the end.

I have examined the type in the Jardin des Plantes and find that it is, unfortunately, very mildewed. The lighter abdominal bands are basal on the segments, and there is a series of brilliant white spots rather on the venter than on the sides. Where distinguishable the tarsal bands occupy quite half the length of the joints. The scales of the veins of the wings are brown.

Description from "F.R.," p. 251.—Generally umber-brown (of the colour of a wall-flower, yellower in the ♀), spotted in various parts of the head, thorax and abdomen with silver-white; dorsum of the thorax grey, with four longitudinal brown lines; pleuræ silver-spotted. (?) Wings fuscous; (?) legs as above; abdomen dorsally brown, with lighter bands; spotted silver-white laterally and on the venter. Length 2-3 lines; of a specimen determined by Rondani 7 mm.

Habitat.—Described from an ill-preserved specimen by Meigen, from Portugal; Stephens records it from England, with a note of interrogation; Rondani notes it from Italy, but the specimen cannot be traced in his collection. Macquart, in his "D.E.," notes that it has also been found in Northern Africa, and also in Smyrna by M. Bigot; and adds that it differs from the type by its black colour, in possessing two longitudinal lines on the thorax, and by the white incisions of the second to the fifth abdominal segments.

31. **CULEX ANNULIPES,** Meigen.

Wings unspotted; tarsi brown, with white basal bands; thorax dark ferruginous with two faint darker converging lines; abdomen yellowish-grey with ill-marked bands, but without lateral spots.

Description from "F.R.," p. 260.—Proboscis rather yellowish, darker at base and apex; palpi of the ♂ yellowish, with the apices of each joint darker, with brown points and tomentum; yellow in the ♀, especially at the base, less so at the apex; antennæ of the ♂, with more brilliantly tinted plumes; yellower in the ♀. Nape with ferruginous tomentum. Eyes clear metallic green, with contours of light tomentum. Thorax dorsally dark ferruginous, with two faint, darker converging lines, and lighter tomentum at the margin; pleuræ speckled whitish. Wings more or less light ferruginous; legs generally yellowish; coxæ yellowish basally and beneath, darker at the apex, the tibiæ the same; joints of the tarsi browner, with white basal rings; abdomen laterally ciliated yellowish, dorsally light yellowish-grey, with ill-marked bands. Total length 10-12 mm.

Ficalbi describes ♀ specimens, received by him from Germany, 10 mm. long, as follows:—Palpi very brown; nape and the dorsum of the thorax rather brownish, ferruginous; abdomen dorsally uniformly light yellow; wings with the fourchettes with the branches longer than the stems, and the hinder stem the shorter; coxæ light yellow, speckled black above; tibiæ and tarsi also light yellow, the joints of the latter nearly black at the apex, with three or four white basal rings, progressively narrower in the lower joints, so that the last is sometimes entirely black.

Meigen and Schiner say that it is near *C. cantans*, but more ferruginous, especially in the ♀.

Habitat.—Germany (Meigen); Austria (Schiner); England (Walker); Zetterstedt (Sweden); Gimmerthal (Russia); Ficalbi has not found it in Italy.

32. **CULEX RICHARDII,** Ficalbi.

Wings unspotted; tarsi with light yellowish basal bands; thorax burnt umber-brown, with short golden tomentum and two darker spots on either side of the middle line; abdomen black with 6 trapezoidal yellowish lateral marks.

Description from "F. R.", p. 251.—Proboscis of the ♀ dull yellow, with some black specks, for its proximal two-thirds, and distally black, with, viewed from beneath, a little black at the root also; of the ♂, black at the base, yellow in the middle, and black at the apex; palpi of the ♀ black, markedly chequered with dull yellow, especially at the articulations, and apex, which may be of that colour, but not so as to form a distinct ring; those of the ♂ surpass the proboscis by the length of the last joint, which is slightly spatulate; the last two joints, and especially the penultimate, are furnished with long, dark brown hairs: seen from above, the ♂ palpi are light impure yellow with four black rings, one near the base, two intermediate, and one near the end which, however, remains black. Antennæ of the ♀ brownish-black, with a trace of whitish at the articulations, while in the ♂ the plumes are dark brown, with the whitish articulations more distinct; eyes rather dark metallic-green, with whitish tomentum on the contours; ground colour of nape brown, but some golden tomentum and white scales give it a whitish appearance; thorax of a burnt umber tint, with short golden tomentum and abundant long dark brown bristles, and two darker spots on either side of the middle line; pleuræ lighter with impure yellowish spots and specks; scutellum glabrous, dark yellow; halteres yellowish-white. Wings fuliginous, the veins with black scales intermixed with a few of dull yellow, especially on the margins; fourchettes with the branches longer than their respective stems; coxæ with dull yellow, mixed with a few black scales; ground colour of femora yellowish, so speckled with black that the latter colour predominates and forms a completely black ring near the end, which latter part, however, is white so as to form a white knee point, in which,

however, the tibia does not participate, the black specks less numerous beneath; tibiæ adorned in exactly the same manner as the femora; tarsi black with dull yellow rings placed as follows:—one at the base and another at the middle of the first joint; the second, third and fourth with broad basal rings; and the fifth with a distinguishable ring in the hind legs only; abdomen of the ♀ black, with no regular bands, but only some dull yellow specks; there are, however, six bright yellowish trapezoidal spots along the sides, and the sides are adorned with a thick border of fine, rather long, yellowish hairs; ventrally her segments are dull yellow, darkened by an admixture of black scales on their hinder portions, the lighter anterior portion extending backwards laterally so as to form a sort of triangular spot on each segment, and being broader than the dark part in the first two segments. In the ♂ the lateral fringe is longer and the segments are often a little lighter tinted at the base of the segments on the dorsum; ventrally the segments are dull yellowish, with triangular black spots, apex forwards, at the back of the segments. Length, including the proboscis, of the ♂ 7-8 mm.; of the ♀ 9-10 mm.

Habitat.—Italy. The female bites man and mammals, at dusk and also by night, sometimes even by day; the male is harmless.

33. **CULEX SOLICITANS,** Walker.

Wings unspotted; tarsal joints with basal white bands; thorax with two black stripes; (?) abdomen with a pair of quadrangular black spots on each segment, the hind two of which are narrower; proboscis with a distinct white band in the middle.

Arribálzaga, "L. A.," p. 48, makes this species a synonym of *C. tæniorhynchus*, but in view of the doubt whether the latter represents one of a group of species. This species is provisionally maintained.

Description from Walker, "Insect, Saunders," p. 427. ♀—Black with fawn-coloured tomentum; proboscis long, slender, curved, testaceous, black towards the tip. Antennæ

black, testaceous at the base. Thorax fawn-coloured, with two black stripes; pleuræ and pectus whitish; abdomen with two lateral black quadrate spots on each segment, the two apical segments with narrower spots; legs slender; tarsi black with white bands. Wings greyish; veins testaceous, fringed with minute black scales; halteres testaceous with brown knobs. Length of body 3 lines; of the wings 5 lines.

There is little doubt that this species is synonymous with one of the two (or more) species that go by the name of *C. tæniorhynchus*. The description of the abdomen is accurate, and is, as a matter of fact, a much more exact one than that given in the original description of the latter species, *i.e.*, if the British Museum specimens of it are correctly named. Nor is there any noticeable difference between them and the present species, as Walker's type has a distinct, lighter band on the middle of the proboscis. The darker stripes on the thorax appear to be most probably merely the result of local rubbing. The wing has the anterior fork-cell long and narrow, and the posterior broad and rather triangular. The banding of the tarsal joints is basal in position.

Habitat.—United States.

34. **CULEX TERRENS,** Walker.

Wings unspotted; tarsal joints with basal white bands; thorax white-pubescent, with two brown stripes; abdomen without banding, of a lighter character.

Description from Walker, "Insect. Saunders." p. 429.—Brownish with a silvery-white tomentum; proboscis slender, straight, as long as the palpi. Antennæ with whitish reflections; thorax with two brown stripes; abdomen blackish, very pubescent on each side, with silvery white bands beneath; legs blackish; femora with white tips; tibiæ partly with whitish reflections; tarsi with white bands; wings greyish; veins brown, slightly ciliated; halteres testaceous with brown knobs. Length of the body 3 lines; of the wings, 5 lines.

In Walker's type, the banding of the tarsi seems rather peculiar, at least, on the hind legs. In these there is a basal white band on the first and third joints, and the whole of the second joint is white, save the extreme apex. The fourth and fifth joints are entirely dark, but this of course may merely mean that they are rubbed.

Habitat.—South America.

35. **C. MALARIÆ,** Grassi (1898).

Wings unspotted; tarsi with basal white bands, so narrow as to be plainly visible only on the hind pair; thorax undescribed; abdomen black with clear basal bands, almost bicuspid on the forepart of the segments.

Description from Ficalbi, "Venti Specie de Zanzare Italiane" (1899), p. 175.—Palpi of the male vaguely banded; stem of the anterior fork-cell shorter than that of the posterior. A very small species not exceeding 7 mm. in length, including the proboscis.

Habitat.—Italy. Found by Grassi in all parts where malaria is common, as in the Campagna.

36. **CULEX CINGULATUS,** Fabr.

Wings unspotted; tarsi with basal white rings; thorax ferruginous, unadorned; abdominal segments with basal white bands.

Not to be confused with the species so named from Java, by Doleschall.

Ferruginous, with the proboscis, palpi, and all the tarsi banded white. Almost 3 lines (German) ♂, from South America.

Fabricius, "S. A.," 36, 11; *Culex cingulatus,* brick-red with the haustellum and hinder tarsi ringed white; of the size of *C. pipiens,* entire body brick-red. Head reddish yellow; base of the antennæ ferruginous, with silky

yellowish hairs; proboscis yellowish-brown at the tip; palpi brown, the root of each joint white. Thorax bright ferruginous; pleuræ yellowish; abdomen yellowish; wings and legs yellowish; tibiæ with brown, variegated white covering; tarsi brown with each joint white at the base; the apex of the front tarsus is wanting, but the base of the remaining joint is white-banded also. Type in the Royal Museum of Copenhagen.

A specimen in the British Museum has the abdominal segments rather dark brown with basal white bands. The name, too, seems to indicate a banded type of insect.

37. **CULEX VEXANS**, Meigen.

Wings unspotted; tarsi with basal white bands; thorax dorsally dark brown, unadorned; abdomen nearly black with basal white bands; no lighter bands on the proboscis.

The type in the Jardin des Plantes, is in good preservation. The proboscis is brownish-yellow, darker at the tip; palpi fulvous; antennæ brown; head black, with yellowish tomentum on the nape and round the eyes; thorax dark brown, with indications of two darker lateral lines, on much yellowish tomentum. Wings yellowish, with scattered patches of dark coloured scales along the costa and veins, and a whitish internal marginal fringe; the supernumerary and middle transverse veins $\frac{2}{3}$in, but are not in a straight line, forming an open angle with the point forwards; the stems of the fork-cells are of about equal length; the second posterior cell being only a little shorter and broader than the first sub-marginal; legs with the tarsi light brown, the joints with basal yellowish-white bands; abdomen dorsally rather dark brown with basal whitish bands to the segments.

Description from "F. R." p. 256.—Head brown, with yellowish tomentum on the nape; thorax dorsally dark brown; wings brownish; legs with the coxæ yellow at the base, and beneath brown distally, the tibiæ the same; and

the tarsi with basally white ringed brown joints; abdomen brownish black, with white bands. Length of the ♀, about 7 mm.

In his "Venti Specie de Zanzare Italiane" (1899), p. 125, Ficalbi gives an elaborate supplementary description, in which he states that the thorax has a pale golden tomentum and is unadorned. The first four tarsal joints narrowly basally light banded; the basal abdominal bands are narrow in the middle. The ♂ palpi are longer than the proboscis, brownish-black, the joints somewhat paler at the base; those of the female have a minute rounded fourth joint, and are uniformly brownish-black with pale specks; the male claspers are figured with a peculiar bifid claw.

Habitat.—Meigen describes this species from Berlin; Schiner, from Austria; Gimmerthal from Russia, and Zetterstedt from Scandinavia.

38. **CULEX EXCITANS,** Walker.

Wings unspotted; tarsal joints (the first two only) basally white banded; thorax unadorned, clothed with white hairs; abdomen with basal white bands; proboscis without lighter bands.

Description from Walker, "List," p. 4.—Body pale yellowish-brown, adorned with a silvery lustre on either side; proboscis and antennæ dark brown; the tip of the former black; chest clothed with white hairs; abdomen with a broad white band of hairs on the fore border of each segment; legs dark brown; base of the first and second tarsal joints white; knees white; femora yellow with brown tips. Wings colourless; veins brown; halteres yellow. Length of the body 2 lines; of the wings 4 lines.

The type is a small, stoutly built insect. The wings have the fork-cells both narrow, but the hinder is much the shorter of the two, and with its stem correspondingly the longer.

Habitat.—Georgia, U.S.A.

39. **CULEX STIMULANS,** Walker.

Wings unspotted; tarsal joints with yellow basal bands; thorax brownish-red with yellow hairs, unadorned; abdominal segments with broad yellow basal bands and a few long yellow hairs on their hinder borders; proboscis unbanded.

Description from Walker, "List," p. 4.—♀—Body brownish-red; head and chest clothed with yellow hairs; proboscis and antennæ dark brown; each segment of the abdomen with a band of yellow hairs on the fore border, and on the hinder, a few long yellow hairs; femora pale brown with black tips; tibiæ darker brown; tarsi black, the base of each joint yellow, with tawny tips. Length of the body, $2\frac{1}{4}$ lines; of the wings 5 lines.

The type has the wing with the two fork-cells of about equal length and breadth, the base of the posterior lying internal to that of the anterior while its stem is somewhat the shorter.

Habitat.—Nova Scotia.

40. **CULEX TÆNIORHYNCHUS,** Wied.

C. Perturbans, Walker, "Insect. Saunders." p. 428.—Wings unspotted; tarsi with basal white bands; thorax dark fawn colour, unadorned; abdomen dusky, with whitish bands on the hinder borders of the segments; proboscis with a single white band on the middle of its length.

Arribálzaga, "L. A.," p. 47; has instituted for this and some neighbouring species, the new genus *Tæniorhynchus,* but the characters, apart from the banding of the proboscis, do not appear to sufficiently mark them off from *Culex,* so they have been left under the old nomenclature, in the present compilation.

Description from "L. A.," p. 48.—*Culex tæniorhynchus,* Wied., "D. E.," p. 43 and "A. Z. I.," p. 6; Walker,

"List," p. 3; Osten-Sacken, "Cat. N. Amer. Dipt.," p. 31 *Culex damnosus*, Say, "Journ. Acad.," Philadelphia, III. 11, 3 (1882); *Culex titilans*, Walker, "List," p. 5; *Culex solicitans*, Walker, "Insect. Saunders." p. 427; (?) *Tæniorhynchus tæniorhynchus*, Arribálzaga, "L.A.," p. 48.—Head fuscous, dark cinereous behind, ♀; or silvery grey in the ♂; eyes greenish-black with a very narrow silvery margin. Antennæ fuscous, sometimes obscurely white ringed, the verticils fuscous, darker in the ♀; proboscis of the ♂, slightly golden fuscous, of the ♀, dusky black, with a yellowish white ring in the middle; palpi of the ♀, dusky black, with the extreme apex ashy or whitish, of the ♂, fuscous, with plumes of the same tint, somewhat grey at the joints; thorax dark fawn, but with long dusky hairs; pleuræ fuscous, frosty cinereous (*sic*). Wings hyaline, the veins densely clothed with large fuscous scales; legs fuscous or black with scanty yellow scales; femora pale yellow, with yellow scales in front; anterior tarsi with three and the hind and middle with five whitish bands; first tarsal joint a little shorter than the tibiæ. Abdomen (♂) pale fuscous above, covered with intermixed fuscous and golden scales, with long fuscous hairs on either side; of the ♀, dusky black above, the segments with narrow yellowish-silvery apical bands, much narrowed externally; and below fuscous with grey scales. Length 6-7 mm.

Note by Dr. J. R. Schiner, "Reise der Novara," p. 31.—Three females were obtained from South America, which appear to correspond to Wiedemann's description. A principal reason is that there is a whitish yellow band on the middle of the proboscis, and that the metatarsus of the fore-legs wants the white mark at its base. It is, however, doubtful if another species might not be based on it. In particular, the veins of the wings lying near the anterior border are so thickly clothed with brownish black scales that the wing appears black-edged.

There are in the British Museum collection, some specimens labelled with this name, in which, in addition to the basal light bands of the abdominal segments, the

latter show also a median whitish stripe which broadens towards the back of the segments so that it would be fairer to describe them as whitish with large dark lateral spots. Arribálzaga again, in his description, does not mention any abdominal bands for the male, but states that in the female they have bands on the hinder border.

It is probably for this reason that Howard and Marlatt in their list of Mosquitoes in "Household Insects of the U. S." specify that their *C. tæniorhynchus* is not the same as Arribálzaga's. In any case it is evident that we have to deal with a group of closely allied species or possibly varieties, and that pending the examination of actual fresh specimens any pronouncement on the synonymy is premature.

Habitat.—Mexico, Wied.; Pennsylvania, Wied. and Say; Atlantic States, Osten-Sacken; Honduras, Walker; South America, Schiner; Argentine, Arribálzaga.

41. **CULEX CONFINNIS** (Arribálzaga), (1891).

Wings unspotted; tarsi with basal white bands; thorax pitch-brown; the pleuræ grey; abdomen with narrow white bands on the hind (?) borders of the segments; proboscis with a broad white band in the middle.

May be easily confused with the preceding species, but may be distinguished by the form of the scales of the veins of the wings, which are of the usual clavate form and not deeply concave at the free extremity as in that species.

Description from "L. A.," p. 49. *Tæniorhynchus confinnis*, Arribálzaga, *l.c.*—Very like the preceding, but differs in being of smaller size and darker colour, while the band on the proboscis is broader, but especially in the form of the wing-scales. Antennæ dusky pitch-brown, with thin grey villosity and dusky black hairs; head dark fuscous, with scales coffee-coloured in front and fuscous behind. Eyes dusky black. Proboscis fuscous at the very base and pitchy-black at the apex; with a broad band, white during life but becoming yellowish after death, extending

from near the base to the middle; palpi pitch-brown. Thorax dark pitch-brown with coffee-coloured scales above, and with dusky black hairs especially thick behind; pleuræ dark frosty grey. Wings hyaline, very pale yellow, the veins furnished with clavate scales; halteres drab, with slightly fuscous knobs. Legs dark fuscous; coxæ pitch-brown; trochanters of a more reddish tint; fore femora fuscous, sparsely decorated with scattered white scales, with a narrow white band a little before the apex, the hinder ones pale towards the base; tibiæ speckled white externally, uniformly coloured inside; knees white; fore and middle tarsi with the first three, and the hinder with four, or all the joints with basal white bands; first tarsal joint distinctly shorter than the tibiæ. Abdomen dark fuscous with coffee-coloured scales above and narrow whitish bands, with a few fuscous hairs; below grey. Length, 4·50-5 mm.

Habitat.—Chaco in the province of Formosa, in Argentina.

42. **CULEX ALBIROSTRIS,** Macquart.

Wings unspotted; tarsal joints all with basal white bands; thorax cinereous, unadorned; abdomen intense black, with distal white bands to the segments; proboscis white, except at the base and tip where it is black, *i.e.*, with a very broad band.

Description from Macquart, "D. E.," p. 10, Suppl. IV. Proboscis white, except at the base and tip where it is black. Palpi black with a little white at the tip. Face white; frons black with a slight brownish down; antennæ blackish with the first joint pale; thorax covered with a rather reddish-grey down; abdomen deep black, with the hinder border of the segments white. Legs pale yellowish, somewhat blackish at the apices of the femora; tibiæ brownish, the hinder ones a little paler in the middle; tarsi blackish, with a white ring at the base of each joint. Wings with normal veins. Length 2 lines ♀.

Habitat.—Akaroa, New Zealand.

43. **CULEX LONGIPALPIS,** Van der Wulp.

Wings unspotted; tarsi with the first three joints basally banded and an additional band in the middle of the first; thorax red-brown, unadorned; abdomen with pale incisuræ; proboscis with a broad pale band; palpi exceptionally long.

Description from Van der Wulp, "Bijdragen der Midden Sumatra Exped.," Deel IV., "Dipt.," p. 9.—Fuscous; with the tarsi white-ringed, the two last joints entirely white; palpi longer than the head, distinctly two-jointed. Length 4·5 mm.

Antennæ brownish-black, indistinctly banded lighter; proboscis yellowish, brownish-black at the root and apex; palpi longer than the head, distinctly two-jointed, each joint growing broader at the end; eyes meeting above the antennæ. Thorax dark red-brown; abdomen brownish black with perceptibly lighter incisuræ; anus ferruginous. Legs with the coxæ brownish-yellow; femora and tibiæ ornamented with partly dark brown and partly white scales, so as to give a spotted appearance; white rings may be observed at the roots of the first three tarsal joints, and in the middle of the first joint; both the last two tarsal joints whitish, a character which is most marked on the hind tarsi; halteres yellow. Wings somewhat ash-grey, with dark brown scales on the veins, the veins towards the middle remarkably nearer the apex of the wing than the hinder veins; both fork-cells almost equally long.

In both the specimens, from which this description is drawn the scales are somewhat rubbed off. In *habitus* it somewhat resembles some of our home gnats, but the largely developed palpi are very characteristic.

The present species is nearest *C. alboannulatus*, Macquart ("Dipt. Ex., Supp." 4, 10, 13), *C. albirostris*, Macquart (*l. c.* 14), *C. dives*, Schin. ("Reise der Novara," 31, 3), *C. nero*, Doleschall ("Nat. Tijdsch. Ned. Ind." XIV. 383), *C. aureostriatus*, Doleschall (*l. c.*, 385), *C. variegatus*, Doleschall (*l. c.*, XVII., 77, 1), all of which have white-ringed tarsi, but positively none of these have the elongated palpi.

Note.—Both in the short Latin and in the longer Dutch description the palpi are described as two-jointed (*biarticulatus*, *tweeledig*), but in the plate, which gives an outline drawing of the head, the palpi are drawn distinctly four-jointed, and as such a character if really present would have something more than a specific value, I conclude that their description as two-jointed is an oversight.

Habitat.—Alahn Pandjang and Sœrœlangœn.

44. **CULEX ANNULIROSTRIS,** Skuse.

Wings unspotted; tarsi basally white-ringed; thorax dorsally deep brown with golden scales and hairs, but with some white marks on the pleuræ; abdominal segments deep brown with narrow white basal bands; proboscis with a broad white band on the middle third of its length.

Description from "S. A. C.," p. 1,737. ♀—Length of antennæ 2·27 mm.; expanse of wings 3·81 × 0·88 mm.; size of body 4·31 × 0·88 mm. Antennæ brown, the length of the proboscis; scapus testaceous, except apical half of second joint. Head nearly black with yellow scales; proboscis deep brown, nearly six times the length of the palpi, with a broad, prominent band of white in its middle third; palpi nearly black, with the third and last joints almost imperceptibly white-tipped. Thorax deep brown, rather densely clothed with yellow scales and hairs; pleuræ deep brown with a few small patches of white scales; a little testaceous under the origin of the wings; scutellum somewhat testaceous brown with long yellow hairs; metanotum deep brown; halteres brownish ochre. Abdomen twice the length of the thorax, deep brown nearly fuliginous; each segment narrowly bordered in front with white scales and fringed behind with golden hairs; white-scaled below. Femora deep brown above, white beneath (in the fore and middle pairs brown predominates), and just white at the apex; tibiæ sordid brown with yellowish-grey reflec-

tion; all joints except the last tarsal basally white-ringed; in the hind legs the tibiæ equal the metatarsi. Wings longer than the abdomen; hyaline; veins densely brown-scaled, chiefly long and slender; cilia brown-grey. Auxiliary reaching costa opposite tip of hinder branch of fifth longitudinal vein; middle and posterior transverse very pale, the former a little the shorter and placed twice its length in front of it; first sub-marginal a little longer and distinctly narrower than the second posterior cell, its base almost opposite but slightly beyond that of the latter; anterior branch of fifth longitudinal as in *C. flavifrons*. (No. 50, p. 256).

Habitat.—Blue Mountains (Masters); Berowra, N.S.W. (Skuse). January.

45. **CULEX SITIENS**, Wied.

C. impellens, Walker, "Journ. Proc. Linn. Soc.," Lond., IV., p. 91. *Culex sp.*, Williston, "North American Fauna," Washington Government Printing Office, 1893. Wings unspotted; tarsi with basal white bands; thorax brown, unadorned (except in certain lights); abdomen with distinct white bands; proboscis with a whitish band a little beyond the middle.

Walker's description is so incomplete, that unless, as appears most probable, it be a synonym of the above, it can only retain a nominal status; while Williston's description answers so well to Wiedemann's that there can be little doubt of their identity.

Descriptions from Wiedemann, "A. Z. I.," p. 544.; Walker, *l.c.*; and Williston, *l.c.*—Black; with the proboscis, bands on the abdomen, and joints of the legs white. Length 2¼ lines (German). *Habitat.*—Sumatra.

Colour of the body brownish black; under side of the head and extreme tarsi yellowish; proboscis with a brighter yellowish white band a little beyond the middle. On the thorax there appear, in certain lights, two thick, brighter

stripes lying together. Bands on the abdomen very clear, on the belly they appear very closely approached, yet brighter. Wings with brownish black scales; femora with a yellowish covering; knee and all the other articulations, white. The specimen described is noted as in very defective condition (Wiedemann).

♀.—Brown, testaceous beneath; proboscis blackish with a white band, a little longer than the thorax. Legs with pale reflections; femora whitish with darker tips; joints of the tarsi white at the base. Wings grey; veins black, fringed. Length of the body 2½ lines; of the wings 4 lines.

♀.—Dark brown or black, the occiput covered with white and brown tomentum. Palpi black, at the tip silvery; proboscis black, with a white ring beyond the middle. Antennæ black; dorsum of the thorax covered with brown and white tomentum, the white towards either side posteriorly, forming two slender lines abbreviated anteriorly; pleuræ with white tomentum; abdomen deep brown, with six conspicuous rings of white tomentum on the anterior part of the segments, the ground colour under them yellow; on the second segment a white tomentose spot in front. Legs nearly black, the base of all the femora yellowish; on the outer side of the femora, in large part, and along the whole inner side of the legs, as also moderately broad rings at the articulations of all the tarsal joints, white. Wings nearly hyaline; tomentum blackish, distributed nearly evenly on the veins. Length 6 mm.

One specimen, Argus Mountains, California, April. This species is closely allied to *C. annulatus*, Meig., which occurs in the Western regions and in Mexico, but seems to differ in the evenly distributed tomentum of the wings (Williston), *Culex sp.*

Of Walker's type of *C. impellens*, there is little left but the wings. These remains conform, as far as they go, to Wiedemann's description.

The wings have the anterior fork-cell longer and much narrower than the posterior, their bases even; the posterior is placed a good deal internal to the middle transverse vein.

Habitat.—Makessar, in the Celebes (Walker), *C. impellens*.

46. **CULEX RUBRITHORAX,** Macquart.

Wings unspotted; tarsal joints with white rings, especially distinct on the hind legs; thorax brick-red, unadorned; abdomen black with whitish incisuræ; proboscis tawny, black at base and tip (sometimes all black), evidently with a tendency to banding.

Description from "S. A. C.," p. 1,735.—*C. rubrithorax*, Macqt., "D. E.," IV. Suppl., 1850, p. 9. ♀—Thorax brick-red; abdomen black, with whitish incisuræ. Legs yellowish; tarsi fuscous, white banded. Proboscis tawny, black at the base and end, sometimes entirely black; palpi black, basally tawny; frons brown, with a grey pubescence. Antennæ black; ground colour of thorax testaceous; abdomen black, somewhat shining, with a light grey pubescence about the incisions. Legs palish tawny; hind femora sometimes black within their posterior third; hind tibiæ brown black; tarsi black, sometimes yellowish; the first three joints with a narrow, sometimes indistinct, basal white ring, and large ones to the hind legs. Wings rather limpid; veins normal, covered with small black hairs. Five ♂ specimens, the tarsal rings nearly absent in one. Length 2½ lines.

Habitat.—Tasmania.

47. **CULEX VIGILAX** (Skuse), (1889).

Wings unspotted; tarsal joints violet-black with white basal bands; thorax black, mottled with golden scales and setæ, but unadorned with any distinct marks. Abdominal segments narrowly banded in front with yellow, and with a lateral patch of pure white, and with a tendency to bending of the proboscis.

Description from "S. A. C.," p. 1,731. *Female.*—Length of antennæ 2·27 mm.; expanse of wings 1·27 × 4·31 mm.; size of body 5·08 × 1·13 mm. Antennæ dark brown, three-quarters the length of the proboscis, joints of the scapus ochraceous brown; head covered with dark

brown and indistinctly mottled with yellow scales; proboscis about seven times the length of the palpi, almost black, ochreous beneath, from just beyond the base to a little beyond the middle; palpi dark brown, the last joint with white scales at the apex. Thorax almost black, densely covered with scales to match, and mottled with small patches of golden scales and setæ; metanotum nearly black, somewhat testaceous laterally; halteres entirely ochreous; abdomen barely twice the length of the thorax, violet-black scaled, each segment except the first with a narrow band of pale yellowish scales in front, the first beset with numerous golden setæ, and sprinkled with whitish scales; all segments with a small patch of pure white scales laterally, below the ends of the light banding; venter yellowish-white scaled; lamellæ of ovipositor deep brown; coxæ light brown with white scales. Femora violet-black above and at the apex sprinkled with whitish scales, beneath whitish; nearly wholly violet-black in the fore legs; genua bright golden; tibiæ violet-black, sprinkled with yellowish scales; tarsi violet-black, each joint with a narrow white ring at the base, rather indistinct on the last two joints of the fore and middle legs. In the hind legs the metatarsus rather more than two-thirds the length of the tibiæ. Wings longer than the abdomen, hyaline, pale yellowish in front, veins covered with slender brown scales, cilia grey, rather brilliant reflections. Auxiliary vein joining the costa a little before the posterior branch of the fifth longitudinal fork; middle transverse longer than the posterior transverse, placed a little in front of the former; first sub-marginal somewhat longer and slightly narrower than the second posterior cell, the base of the former placed a little beyond that of the latter; anterior branch of fifth longitudinal originating opposite a point about midway between the origin of the second longitudinal and the tip of the sixth longitudinal vein, joining the posterior border opposite the middle of the second posterior cell.

Habitat.—Gosford, Kiama, and National Park, N. S. W. (Skuse), Brisbane, Queensland (Dr. Bancroft and Mr. H. Tryon). November to February.

48. **CULEX IMPATIBILIS,** Walker.

Wings unspotted; tarsi with basal white bands; thorax cupreous black (?); abdomen black (?) with interrupted shining bands.

Description from "Journ. Proc. Linn. Soc.," Lond., IV. (1860), p. 91.—Male.—Black, with a very slight cupreous tint. Head with shining white points; sheath of the proboscis dark tawny, longer than the thorax; pectus with shining white dots. Abdomen with interrupted shining white bands, which are most complete beneath. Knees white; hind femora white with black tips; middle tarsi white at the base; hind tarsi with two white bands. Wings cinereous; veins black, fringed. Length of the body 2 lines; of the wings 3 lines.

There is very little left of Walker's type, the abdomen being wanting; on one remaining tarsal joint the banding is basal in position. In the wing the fork-cells are small with their bases opposite and their stems proportionally long, although the transverse veins are placed rather far out on the wing.

Habitat.—Makessar, in the Celebes.

49. **CULEX PROCAX,** Skuse.

Wings unspotted; tarsi with basal white bands; thorax red-brown with golden scales, unadorned; abdomen black, the segments narrowly banded white in front and fringed yellow behind; proboscis darker at the tip.

Description from "S. A. C.," p. 1,742. ♀—Length of antennæ 2·02 mm.; expanse of wings 3·30 × 0·88 mm.; size of body 3·81 × 0·76 mm. Antennæ brown, nearly the length of the proboscis; first joint of scapus entirely and the second basally, ochreous. Head light umber-brown, adorned with golden scales; proboscis brownish-ochre, dusky at the tip, about nine times the length of the palpi; palpi light umber-brown. Thorax red-brown, gold-

scaled; pleuræ red-brown, with small patches of white scales; scutellum and metanotum red-brown, the former with golden scales and long hairs; halteres ochreous. Abdomen hardly twice the length of the thorax, black, each segment narrowly white-banded in front, and golden fringed behind; venter white-scaled; lamellæ of ovipositor brown. Legs brown, the under-side of the femora white, and the tarsal joints basally white-banded; in the hind legs the tarsi a quarter longer than the metatarsi. Wings longer than the abdomen, barely brownish, pellucid, veins thickly clothed with slender brown scales, cilia grey, brilliant reflections. Auxiliary vein joining the costa a little before the hinder branch of the fifth longitudinal; middle somewhat longer than the posterior transverse; placed about its length in front of the latter; first sub-marginal a little longer and much narrower than the second posterior cell, their bases exactly opposite each other; anterior branch of fifth longitudinal as in *C. flavifrons*, &c. (*Vide infra.*)

Habitat.—Gosford and South Clifton, N.S.W. (Skuse), December to February. A day-flying species.

50. **CULEX FLAVIFRONS**, Skuse.

As in the preceding. Appears to differ only in certain details of the venation of the wings, for which see description.

Description from "S. A. C.," p. 1,735.—Length of antennæ ♂ 1·77 mm.; ♀ 2·27 mm. Expanse of wings ♂ 4·06 × 1·01 mm.; ♀ 4·06 × 1·13 mm. Size of body ♂ 5·08 × 0·88 mm.; ♀ 4·56 × 1·01 mm. ♂ and ♀.—Antennæ in the ♂ light ochre-brown, sericeous, about two-thirds the length of the palpi; first joint of the scapus dusky brown; in the ♀ brown; nearly the length of the proboscis; entire scapus ochre brown. Head densely gold-scaled; proboscis fuscous, sometimes more or less ochreous especially in the middle; in the ♂ somewhat shorter than in the ♀ about six times the length of the palpi; palpi fuscous; in the ♂ with the fifth joint indis-

tinctly basally white-ringed, in the ♀ with the end joint white. Ground colour of thorax red-brown, densely gold-scaled; pleuræ red-brown, with several small, white-scaled spots; scutellum densely gold-scaled, stiff-haired; metanotum light red-brown; halteres with the stem pale ochre and the stem darker. Abdomen twice the length of the thorax, segments violet-black scaled, narrowly white-banded in front, densely fringed with golden hairs; venter white-scaled; ♂ forceps deep brown with dense, long, golden hairs; lamellæ of ♀ deep brown; Coxæ pale red-brown with white scales. Femora dark violet scaled above at the apex, thickly powdered with white scales, beneath pale yellowish; genua bright yellow; tibiæ and tarsi dark violet, the tibiæ and metatarsi somewhat whitish beneath; all tarsal joints whitish ringed at the base, but indistinctly so in the fore and middle legs; hind tibiæ one-fifth longer than the metatarsus. Wings longer than the abdomen, almost hyaline, with a very slight brownish tint, darker at the stigmatic region, the veins densely clothed with violet-brown scales, sparingly intermixed with yellowish scales, cilia brownish grey. Auxiliary vein reaching costa opposite tip of hinder branch of fifth longitudinal; middle very slightly longer than posterior transverse vein, placed rather more than half its length beyond the latter; first sub-marginal cell somewhat longer, and distinctly narrower than the second posterior cell, its base lying slightly beyond that of the latter; anterior branch of fifth originating at a point about midway between origin of second and tip of sixth longitudinal vein, joining the margin opposite middle of second posterior cell.

Habitat.—Blue Mountains, N.S.W. (Masters); Victoria Park, Brisbane (Mr. Tryon). November to January.

51. **CULEX OCCIDENTALIS,** Skuse.

Closely resembles the two preceding, but the palpi of the ♀ have a white ring at the base, and there are some differences in the venation of the wings.

Description from "S. A. C.," p. 1,729.—Female.—Length

of antennæ 2·27 mm.; expanse of wings 5·08 × 1·27 mm.; size of body 5·08 × 1·01 mm. Antennæ almost cinereous, about four-fifths the length of the proboscis; the first joints of the scapus and the basal half of the second ochraceous; eyes bordered behind with a narrow line of golden-yellow scales; followed by a band of deep reddish-brown, the back of the head densely covered with golden-yellow scales; proboscis six times the length of the palpi, brown, darker at the base and towards the extremity; palpi dusky-brown, the fourth joint with a small ring of white at the base, and the terminal joint white. Thorax deep reddish-brown when denuded, densely covered with golden-yellow scales, pleuræ reddish-brown, mottled with several patches of whitish scales; scutellum testaceous, with golden-yellow scales and long brown setæ; metanotum reddish brown; halteres with the club dusky-brown, stem ochre-yellow. Abdomen twice the length and not quite the width of the thorax, dark brown, each segment with a narrow band of whitish in front, and fringed with golden hairs; beneath covered with whitish scales, the segments bordered behind with a narrow band of brown. Legs dark brown; the coxæ and basal half of the femora more or less dusted with whitish or yellowish scales, the apex of the latter slightly tipped with white; also first three tarsal joints white ringed at the base; in the hind legs the tibiæ one-third longer than the metatarsi. Wings longer than the abdomen, hyaline, the veins thickly covered with long slender scales of a brown tint, cilia grey; brilliant reflections. Auxiliary vein reaching the costa opposite the tip of the posterior branch of the fifth longitudinal vein; sub-costal transverse placed a little before origin of second longitudinal; middle transverse slightly longer than the posterior transverse, the former placed in front of the latter a distance equalling its length; first sub-marginal cell considerably longer than the second posterior and narrower, its base being almost opposite, but slightly in front of the latter's; anterior branch of the fifth longitudinal originating opposite a point nearer the tip of the sixth than the base of the second, and joining the margin opposite the middle of the second posterior cell.

Habitat.—King George's Sound, Western Australia, (Masters).

52. **CULEX MACULIVENTRIS,** Macquart.

Wings unspotted; Tarsi inconspicuously basally white banded; thorax black with rufous tomentum, unadorned. Abdomen black, the segments with both the fore and hind borders and a median line yellowish.

Description from Macquart, "D. E.," Suppl. I. p. 7.—Thorax black with rufous tomentum; abdomen black with the incisions and a dorsal line yellowish; tarsi faintly white-ringed. Length 2 lines (♀). Proboscis brown. Palpi black, with the apex white. Antennæ brown. Frons drab. Abdomen black, with both anterior and posterior borders of the segments and a dorsal line of a greyish-yellow. Legs yellowish; tarsi black with a little white at the base of each joint. Wings unspotted.

I have seen the type in the Jardin des Plantes, and this is certainly a most characteristically marked species. It is rather smaller than *C. pipiens*, and the proboscis is rather darker at the tip and base than in the middle. The eyes are black without any sign of lighter margin; the antennæ brown. The thorax and abdomen are absolutely as described, and the markings of the latter are very characteristic; the venter pale with the hinder borders of the segments mottled black. The banding of the tarsi is so inconspicuous that it might easily be overlooked. The wings have the veins clothed with alternate white and dark brown scales, the fringe of the internal border being drab; the second posterior cell is shorter, but a good deal wider than the first sub-marginal.

The relative length of the joints of the palpi were not easy to make out, but this species certainly closely approaches the definition of Arribálzaga's genus *Tæniorhynchus*.

As far as I can see, so far as the descriptions chance to

cover the points involved; all the preceding species, from No. 40 inclusive, as well as *C. Richardii*, Ficalbi, *C. titilans*, Walker, with the probably synonymous *C. fasciolatus*, Arribál.; and possibly *C. Willistoni*, Mihi, and *C. tarsalis*, Coquillet, though in this last, the palpi hardly correspond to the generic description; come within the limits of Arribálzaga's new genus *Tæniorhynchus*, and their removal would give a substantial relief to the at present unwieldy genus *Culex*. The above-mentioned species are, at any rate neighbours of the group, but have been divorced from their nearest natural neighbours by the exigencies of the plan of tabulation, and only a close examination of the actual types could definitely settle whether or not they actually conform to Arribálzaga's definition of his genus, which includes several points not generally included in the descriptions of most entomologists.

Habitat.—Algeria (M. Lucas).

53. **CULEX EXCRUCIANS,** Walker.

Wings unspotted; tarsal joints testaceous, with very pale brown apical bands; thorax red, unadorned. Abdomen testaceous, with broad brownish basal bands.

Description from Walker, "Insect. Saunders.," p. 429. ♀—Tawny, the proboscis testaceous, long, straight, slender, brown at the tip. Antennæ brown, testaceous towards the base, a little shorter than the proboscis; pectus paler than the thorax. Abdomen brownish, with a testaceous band on the hinder border of each segment. Legs testaceous, long, slender; tibiæ darker than the femora; tarsi very pale brown, with a testaceous band at the base of each joint. Wings very slightly greyish; veins testaceous, slightly ciliated: halteres testaceous, with brown knobs. Length of the body; 4 lines; of the wings 7 lines.

From the type in the British Museum, it appears that its salient peculiarity lies in the large size of its wings, which extend well beyond the end of the abdomen, and are also much broader than usual. The anterior fork-cell is

much longer and narrower than the posterior, with its stem shorter. All the transverse veins are long and the posterior is placed rather less than its length internal to the middle transverse.

Habitat.—Nova Scotia.

54. **CULEX DIVES**, Schiner.

Wings unspotted? Tarsal joints basally white ringed. Thorax and abdomen dark brown, with minute white dots laterally. Apices of palpi, bases of antennæ, and frons white scaled.

C. annulipes, Walker, "Proc. Linn. Soc.," I., p. 5 (1857) (?)

Description from Walker, *l. c.* and Schiner, "Reise der Novara," p. 31. Female, dark brown. Sides of the thorax and of the abdomen with minute white dots; legs with numerous white bands. Wings nearly limpid; veins brown ciliated. Length of the body $2\frac{1}{2}$ lines; of the wings 4 lines (Walker).

Schiner, *loc. cit.* notices that Walker's description of *C. annulipes* agrees with his previously described species from Batavia, and adds the following points:—

The apices of the palpi, the basal joints of the antennæ, and the frons are silver-white scaled. The silvery bands of the hind legs are interrupted along their borders, but on the belly again, well marked, The hind femora are yellowish at their bases, and silver-white specks may be made out on all the knees. The metatarsus of the hind legs, and the two next tarsal joints are clear white at the base.

In Walker's type the entire legs are banded, there being a single silvery band at the junction of the middle and distal thirds of the femora, a white knee spot, five distinct bands, on the tibiæ the lowest being apical, a band on the middle and at the base of the first tarsal joint, and broad bands on the bases of all the remaining tarsal joints. The veins of the wings are brindled in much the same way, but the black scaled portions greatly preponderate and the wing

does not appear as spotted to the naked eye. The anterior fork-cell is long and narrow, the bases of the two forks being opposite and their stems equal. The posterior transverse vein is placed about three times its length internal to the middle transverse. The antennæ are also ringed and the palpi (♀) have a white tip. The rather rubbed proboscis is whitish at the point and elsewhere black.

Habitat.—Singapore (jungle).

55. **CULEX TIBIALIS,** R. Desvoidy.

Wings unspotted; tarsal joints with basal yellowish bands; thorax fuscous with grey tomentum, unadorned; abdomen uniform black; tibiæ black hirsute.

Description from Desv. "Essai," p. 404.—Black, with cinereo-fuscous tomentum; antennæ yellowish brown; femora pale yellow, with black cilia at the apex; tibiæ black with strong hairs; first joint of the tarsi with yellow ciliæ; length, 4 to 6 lines.

♂.—Antennæ yellowish brown; palpi and proboscis fuscous; body black, with dusky grey tomentum; femora of the colour of honey, black and hirsute at the apex; tibiæ intense black, robustly ciliate; joints of the tarsi honey-tinted, black at the apices; wings rather dusky, the veins with brown scales.

Habitat.—Brazil.

56. **CULEX IMPRIMIENS,** Walker.

Wings unspotted; tarsal joints with basal white bands; thorax and abdomen alike testaceous, unadorned. (?)

Description from Walker, "Proc. Linn. Soc. V. P.," 144.—Ferruginous; palpi and proboscis blackish; the latter straight, a little longer than the thorax; antennæ ochraceous at the base; thorax with testaceous tomentum; abdomen with a testaceous line, and testaceous sutures above; under-side testaceous; legs testaceous, long; tarsi

brown, the joints whitish at the base; wings cinereous; veins brown, slightly fringed; length of the body 3 lines; of the wings 5 lines. Described from a female specimen.

The type in the British Museum is too rubbed to throw any light on the ornamentation of the thorax and abdomen, but testaceous bands on a ferruginous ground could hardly be very striking. The anterior fork-cell is much longer, but about the same width as the posterior, its stem rather the shorter; the posterior transverse vein is shorter than the middle, and placed about the length of the latter internal to it.

Habitat.—Amboyna.

57. **CULEX TOXORHYNCHUS,** Macquart.

Wings unspotted; tarsal joints with basal white rings; thorax dark, probably ornamented with white lines; abdominal segments with whitish basal bands; proboscis curved upwards.

Description from Macquart, from "Dipt. Exot.," I. (1838), p. 25.—Fuscous, with the proboscis arched; palpi with the last joint silvery; face spotted white; tarsi with white rings; length 2 lines (♀).

Proboscis concave, viewed laterally; front legs wanting, the others with the coxæ and the femora green; middle legs with a little white at the base of the first and second tarsal joints; hind, with a large white ring on the first and second, and the third entirely white, the others wanting; wings iridescent with brown scales.

I have seen the type in the Jardin des Plantes, but it is so denuded that but little additional can be made out from it. The thorax is black, without markings; the abdomen brown, the segments rather darker behind, but there are a few scattered scales remaining, which may indicate basal white banding in the undenuded state. The upcurving of the tip of the proboscis is certainly peculiar. The wings are hyaline, the scales of the veins dark brown, except those forming the internal fringe,

which are whitish. The third longitudinal vein comes off obliquely from the second, without the intervention of any apparent supernumerary transverse, while the middle transverse, springs from this point of bifurcation; the posterior transverse is placed nearly twice its length internal to the middle transverse vein and is shorter than it; the first sub-marginal cell is longer and narrower than the second posterior, the stem of the former being the shorter and its base a trifle nearer the root of the wing. The bases of the two fork-cells are opposite.

There is also a specimen so-named in the British Museum from Colombia, which is better preserved than the type, and in which the characters of the wing correspond to it. In this specimen the occiput is black, with three distinct white lines and there are obvious remains of some similar decoration of the thorax. The abdominal segments have narrow but distinct basal bands. It is certainly very near though not, I think, identical with *C. tæniatus.*

Habitat.—Brazil or Chili (Gaudichaud), near *C. tæniatus.*

58. **CULEX INEXORABILIS,** Walker.

Wings unspotted; tarsal joints with white basal rings; thorax dark brown, unadorned; (?) abdomen wanting.

Description from Walker, "List," p. 4.—Body a dark brown, adorned with a silvery lustre, which prevails especially beneath and on the sides of the body; proboscis and antennæ black; each joint of the tarsi with a white band at the base. Wings slightly brown; veins dark brown; poisers yellow with brown knobs; length of the body 1½ lines; of the wings 3 lines.

The type consists at present of the thorax and wings only. The latter are so like those of *C. tæniatus,* that I strongly suspect that this is a synonym of that species.

Habitat.—West Africa.

59. **CULEX FLAVICOSTA,** Walker.

Wings unspotted (yellowish along the costa); tarsi black with testaceous basal bands; thorax and abdomen undescribed.

Description from Walker, "Insect. Saunders.," p. 431.—Tawny; proboscis and palpi testaceous, the former slender, straight, black at the tip; antennæ brown, testaceous at the base; legs long, stout, testaceous; tips of the femora, the tibiæ, and of the joints of the tarsi black; hind tibiæ thinly clothed with short hairs; hind tarsi, except the first joint, black, the joints testaceous at the base. Wings greyish, darker at the tip and yellowish along the costa; veins brown, ciliated; length of the body 3½ lines; of the wings 6 lines.

In the type in the British Museum, the denuded parts of the thorax are red-brown, there is a median line and two large lateral spots of golden tomentum, but this may result from partial rubbing, rather than from any marking. The abdomen retains a good deal of golden tomentum and probably was not banded.

Habitat.—The Amazon region.

60. **CULEX ARGYROPUS,** Walker.

Wings unspotted; tarsi with apical white bands to the joints; thorax black, with silvery spots on the sides; abdomen black; (?) a silvery spot on each femur near the tip.

Description from Walker, "List," p. 2.—Body black; proboscis full half the length of the body; antennæ shorter than it; sides of the thorax with silvery spots; legs black, very long, a silvery spot on each thigh near the tip, which is also silvery, as are those of the tibiæ and of the tarsal joints. Wings slightly tinged with brown; their fore border black, veins dark brown, thickly fringed with black hairs; halteres dark brown; length of the body 2½ lines; of the wings 5 lines.

The white knee spots are still fairly noticeable in the type, but the tarsal bands are very minute; on the hind legs the last joints are wholly whitish. The wings have both fork-cells long and narrow, even more so than in *C. longiareolatus*, their stems being exceptionally short; both cells being of equal width, but the anterior the longer. The type is very mouldy but the abdomen does not, at any rate, show any signs of banding.

Habitat.—New Zealand.

61. **CULEX CAMPTORHYNCHUS,** Thomson.

Wings unspotted; tarsal joints apically whitish; thorax fuscous with fulvous tomentum; abdomen unbanded, fuscous, with the sides pale; proboscis curved, as long as the abdomen but not banded.

Skuse, "S. A.. C." p. 1,717, regards this species as synonymous with *C. alboannulatus*, but it is difficult to see on what grounds. Both species are described with considerable elaboration, and the points of difference are numerous and considerable, as may be seen by the different position they occupy in the table. On this account one can only regard them as distinct.

Description from "Eugen. Resa., Dipt." p. 443.—Fuscous brown; the thorax clothed with short, glistening fulvous hairs; the legs pale, with whitish tarsi; the proboscis curved, and of the length of the abdomen; wings dark hyaline, with the humeral transverse vein placed more than usually forward. Length ♀, 4 mm.

Resembles and is near *C. toxorhynchus* in size, and the curving of the proboscis, but differs in the colour of the body and legs; dusky, fuscous brown. Head ovately globose, rather narrower than the thorax; the eyes deeply reniform, almost touching on the front; vertex convex, brown, sparsely villous; the proboscis curved, and as long as the abdomen and fuscous, as also are the palpi. Antennæ pale fuscous, not reaching to the apex of the

scutellum, the first joint large and globose, longer than the second and third joints, sensibly longer than the second, with sparse verticils. Thorax fuscous brown, with the pleuræ lighter, compressed, its depth being more than twice its width, which nearly equals its length; pronotum not distinguishable from above. Meso-thorax produced forwards; marbled with short, fulvous-golden, scale-like hairs, with no dorsal lines, and sparsely clothed with long erect, fuscous hairs on the sides and near the wings; convex, distinctly sloping down towards the head; scutellum short, with the impression at the base transverse, and decorated with long porrect, fuscous hairs at the apex; hind scutellum almost vertical, short and pale brown. Wings of the length of the abdomen, darkly hyaline; the veins and inferior margin fringed with easily detachable fuscous hairs; the distinct alular lobe is densely clothed with long hairs; mediastinal vein reaching the costa in its third part, post-costal running out just before the apex; cubital appearing before the middle of the vein, forked, the marginal branch forked and the sub-marginal reaching the apex of the wing; the brachial forked, with the fork just before the apex; the ordinary transverse placed almost near the fork of the sub-marginal branch of the cubital; (?) the humeral forked nearly in the middle of the wing, the transverse vein placed in front of the usual situation; anal vein reaching the inferior margin, the axillary obsolete. Halteres short, fuscous brown, with the club darker. Abdomen nearly twice the length of the thorax, somewhat depressed; inserted high above the hinder coxæ, seven jointed with the second to sixth, segments equal in length and breadth, and the first and seventh very short, the last narrower with two short styles, fuscous, with the sides pale. Legs long, light coloured; coxæ all of equal length, slightly conical, one sixth the length of the femora; these latter the length of the abdomen, not clubbed, spotted, with short, dark fuscous hairs; tibiæ of the length of the femora, sparsely adorned with erect, fragile hairs with no spurs; tarsi elongated, whitish, the joints apically whitish (*sic*), the first almost as long as the tibia, the second and fifth sensibly the

shortest, but half the length of the third and fourth; unguiculi small.

Habitat.—Sidney, Australia.

62. **CULEX SIGNIFER,** Coquillett.

Wings unspotted (but with brindled scales); tarsal joints banded white at both ends; thorax brownish black, with two sub-dorsal, silvery vittæ on the anterior half and arcuate silvery lines laterally throughout. Abdomen violaceous with white basal bands to the segments.

Description from Coquillett, "Canadian Entomol., XXVIII." p. 43. ♀—Head violet-black, its tomentum silvery-white, the pile black. Antennæ, proboscis, and palpi black, their tomentum mixed brown and silvery white, that on the apices of the palpi wholly silvery. Thorax velvety brownish-black, marked on the anterior half with two silvery-white, sub-dorsal vittæ, and with a pair of silvery-white arcuate, lateral lines extending the entire length of the thorax; pleuræ marked with several spots of silvery-white tomentum; scutellum with two spots of similar tomentum on the upper side, and one at the tip. Abdomen black, its tomentum violaceous, that at the base of each segment white. Legs brown, femora largely yellowish, the tomentum mixed brown and silvery, that at the apices of the tibiæ pure white, each end of the tarsal joints white, most extended on the hind tarsi; tarsal claws destitute of teeth on the under side. Wings hyaline, veins yellowish, the scales mixed brown and white. Near *C. fasciatus*, but the silvery line on the thorax is not strongly bent in at the middle, and the tarsal claws are not toothed.

Habitat.—District of Columbia, British North America, in June.

63. **CULEX TARSALIS,** Coquillett.

Wings unspotted; both ends of tarsal joints broadly white; thorax black with yellowish tomentum, a dorsal grey vitta, and an undulating subdorsal white line on either

side; white spots in front of scutellum, above roots of the wings and on the pleuræ. Abdomen black, with basal white bands; proboscis white banded.

Description from Coquillett, "Canadian Entomol., XXVIII." p. 44.—Head black, its pile and tomentum mixed brown and white. Antennæ brown, apices of joints one to eleven broadly white, the hairs grey; proboscis nearly twice as long as the head and thorax united, naked, black, marked near the middle with a broad white ring; palpi slender, tapering to the tip, brown, the base of each joint white, the sides of the last two joints and the outer side of the preceding one, rather long grey pilose. Thorax black, marked with a dorsal grey vitta, its tomentum yellowish, except a white, subdorsal, undulating line on either side, a spot in front of the scutellum, above the root of each wing, and on the pleura. Abdomen black, a fascia of white tomentum at the base of each segment, and at the apices of the last three. Legs brown in front and behind, covered with white tomentum, bases of the femora yellow; both ends of the tarsal joints broadly white, front and middle tarsal claws each bearing a tooth on the under side, hind claws simple. Wings hyaline, scales of the veins brown, with a few white intermixed; ♀ the same as the ♂, with the exception that the palpi are black, its apex broadly and the inner side of the apex of the penultimate joint covered with white tomentum; the antennæ wholly brown; the tarsal claws destitute of teeth; and the thorax sometimes yellowish-brown. Length 4·50 mm.

Habitat.—Argus Mountains, California.

64. **CULEX DORSALIS**, Meigen.

Wings unspotted; tarsal joints with yellowish rings at both ends; thorax dusky, with a pair of divergent yellowish lines united behind; abdomen black with yellowish basal bands and a white median line.

I have seen the types in the Jardin des Plantes, and they afford a good illustration of the uncertainty of the older

descriptions of gnats. One of the types is really, I think, a specimen of *C. pipiens* that has somehow got misplaced, but the other four, which are in very fair condition, answer well to Mr. Austen's description, although this, as may be noticed by comparing the descriptions given below, contradicts Meigen's description in some points. It is certainly a very distinct species, the only one with the abdomen much like it being *C. maculiventris* (Macqt.). The palpi are brown in the ♂, lighter at the bases of the joints, but not distinctly banded, with a large tuft of hairs at the base and another at the apex of the penultimate joint. The first sub-marginal cell of the wing is narrower, but somewhat longer than the second posterior.

Descriptions from "F. R.," p. 246, and from E. E. Austen, "Ent. Month. Mag.," 1895, p. 228.—Head generally brownish-black, with yellowish tomentum on the nape. Antennæ brown with yellowish reflections; thorax dorsally dark brown with traces of longitudinal streaks; pleuræ speckled whitish. Wings clear brownish; legs with the coxæ and tibiæ generally yellowish but browner at the end; tarsi ringed as described above; abdomen with the dorsum grey, and with black spots, generally to the number of four, or more rarely with traces of two others behind on either side. Total length 8—9 mm.

Rondani makes this a synomym of *C. rusticus* (Rossi), but Ficalbi dissents from this (Ficalbi's "Revisione.")

This species may readily be distinguished by the fact that the joints of the tarsi are shining yellowish-white at the tip as well as at the base. The abdomen is yellowish-white, with a pair of quadrangular black spots on each segment, somewhat indistinct at the tip and leaving transverse bands on each segment and a narrow central line yellowish-white. The thorax is badly described by Schiner "Fauna Austriaca, *Diptera*," Vol. II., p. 626); in the female, at any rate, it is dark brown, thickly clothed above with short, close-lying pile of a tawny hue, becoming whitish-yellow behind owing to the junction of a pair of somewhat divergent narrow stripes of the same colour, which run from the front to the hind margin. The anterior

margin of the thorax is narrowly whitish-yellow in the centre of the dorsum, while the head is clothed with pile of similar colour with a narrow tawny spot on each side above. The bright-coloured thorax with its paler stripes, the chequered abdomen and the banded tarsi make this an exceedingly pretty little species. Its length is about 5 mm.

Distribution.—Originally described by Meigen from a ♀ specimen from Berlin. Walker, "List," I., p. 3, 1848, mentions a single specimen from England. Zetterstedt, "Dipt. Scan," IX., p. 3,465, 1850, records it from Southern Scandinavia, Denmark, and Sweden. Van der Wulp, "Dipt. Neerland." Eerste Deel, 1877, p. 325, states it is somewhat rare in Holland. Finally A. Piffard, *loc. cit.* p. 227, states that it is a great nuisance at Aldeburg in England, where it is known as the Norway Mosquito, and is said to have been introduced by a yacht that plied to Norway, about 1870 (Austen).

Habitat.—Near Berlin (Meig.); Austria (Schiner); Scandinavia (Zetterstedt); Ficalbi has not met with it in Italy.

65. **CULEX PENICILARIS** (Rondani).

Wings unspotted; tarsal joints with very narrow pale rings at both ends; thorax of a brazen hue, with (generally) a line of lighter colouring on each side of the middle line; abdomen yellowish with triangular black lateral spots and a black median line. Last two joints of ♂ palpi somewhat dilated.

Description from "F. R." p. 266.—Proboscis yellowish for the proximal two-thirds, brownish black for the remaining third, and on a small area beneath near the root of the palpi. Palpi of the ♀ dark brown with a little yellowish at the apex; those of the ♂ surpass the proboscis by half the length of their last joint; are brown above, at the base, and straw-coloured in the remainder of their length except a dark brown ring a little in front of the base and the last third of the antepenultimate joint, which is dark brown,

this joint being also furnished with long light brown hairs, especially on its external aspect, as are also, to a less extent, the last two joints, which are somewhat dilated, and are dark brown on a yellowish ground with a minute whitish basal ring in each. The antennæ of the female with the basal joint yellowish scaled, and the rest of the appendage with its verticils, dark brown but with light yellow tomentum; in the ♂ generally light brown with the plume exceptionally large, and with the basal joint yellowish scaled. Nape ivory-tinted in the middle, greyish flaxen at the sides; margin of the eyes ivory white; sometimes the nape is uniformly light yellow, with the margin of the eyes lighter. Eyes metallic green. The thorax has a generally brassy tint, produced by a dense opaque tomentum, rather darker, with a reddish tint at the sides in front of the insertion of the wings, and often with a line of lighter colour along either side of the middle line. As, however, the tomentum is particularly easily rubbed off, specimens in collections generally show little else than the dark brown surface of the tergum. Halteres yellowish; legs with the coxæ clothed with yellowish scales; femora generally of the same colour, but in some individuals they are brindled with dark brown above; in any case, there is a small dark brown ring just above the distal end, which last is lighter, forming with a similar area on the tibiæ a whitish knee; tibiæ, as a rule, of a darker shade than the femora and deepening a little before the distal end so as to form a sort of dark ring, followed by a minute whitish band. The tarsi are brown, sometimes tending to a yellowish shade, banded as above described. In the ♀ the claws of all three legs are of nearly equal size, and in each foot the pair of claws are also equal, every claw presenting near its base a well-developed tooth; in the ♂, however, the claws of the hind legs alone answer to this description, while, in the middle and fore feet the pairs of claws are unsymmetrical, the anterior claws being much the larger, while, in the fore feet alone the anterior claw has two teeth instead of one, as in all the other claws. (Ficalbi's figure of the "♀" claws exactly corresponds to his description of those of the

male. Possibly the female in the description of the figure is an undetected printer's error). The abdomen in the ♀ is coloured dark chocolate brown and yellowish, of varying intensity, the latter predominating, the yellow tint forms a median line, continuous with basal bands to each segment, and there are, in addition, five or six lighter semi-lunar yellowish spots, forming transverse bands occupying not only the base of the segments but spreading a little into the distal part of the segment before it; the lighter tint predominating especially in the first and two last segments. Ventrally, the abdomen is yellowish, with a slender median black line, and (generally four) black lateral spots to match with those on the dorsal aspect. In the ♂ the abdomen is moderately fringed with yellow hairs and the yellowish is usually lighter, but the dark part is in the form of lateral, triangular spots, with the bases behind, most marked on the fifth, sixth and seventh segments, and showing a tendency to coalesce in the second, third and fourth, while the eighth has only a single median spot; ventrally the abdomen of the ♂ is ivory tinted with a median dark line and small lateral spots of the same colour in each segment. Length varies greatly, from 5 to 9 mm. in the ♀, and nearly the same in the ♂.

Assuming the tarsal adornment to correspond, *Culex bipunctatus*, R. Desv., No. 79, would be placed here.

Habitat.—Italy, especially the litoral; Ravenna and the Tuscan marshes. From an examination of Rondani's collection Ficalbi finds that, though near, this species is quite distinct from *C. pulchritarsis*.

66. **CULEX LEUCACANTHUS**, Loew.

Wings unspotted; tarsal joints (some at least) with white bands at both ends; thorax brazen yellow, with two ill-defined darker longitudinal streaks; abdominal segments black with basal white bands; palpi of the ♂ whitish; an abundance of whitish hairs on the body.

Description from "F. R.," p. 265.—Palpi of the ♂

whitish, with whitish reflections, which are also given by the remainder of the hairs of the organ. Antennæ of the ♂ with blackish hairs at the extremity, but with whitish reflections; frons and nape with tomentum and hairs of a pale brassy tint. Thorax with the dorsum coloured like the nape, or rather yellower, with two ill-marked, darker, longitudinal streaks; pleuræ speckled snow-white. Wings with the scales of the hinder margin characteristically brilliant white; legs with the femora whitish; a white knee-spot, formed by the contiguous portions of the femur and tibia; tarsi all white-ringed, those of the fore and middle legs on the bases and apices of the first and second, and on the base of the third joints, the fifth being entirely white, forming in all four rings, while on the hind legs there are five rings, one being placed on the base of the first, the next three on the contiguous portions of the succeeding joints, and the fifth formed by the last joint being entirely white; abdomen with abundant pale yellow hairs, especially laterally; the dorsal surface black, with basal white bands of equal size. Very minute (1⅔ lines). The ♂ alone is known.

Habitat.—Kasan.

67. **CULEX PULCHRITARSIS,** Rondani.

Wings unspotted; tarsi finely ornamented with broad white bands involving two contiguous joints. Thorax without special adornment, with golden-yellow tomentum; abdomen with white basal bands.

Description from Ficalbi, "Venti Specie de Zanzare" (1899), p. 133. Ficalbi's description is based upon fresh specimens, about the identification of which, by comparison with Rondani's type, he feels no doubt. Head generally brown, most marked at the extremity; palpi ♂ a little longer than the proboscis, moderately clubbed; moderately hirsute, brown, with rings at the bases of the three last joints; the hairs maroon-brown, but those at the apex are pale. The ♀ has a small olivary fourth joint brownish black with a whitish apex. Antennæ (♀) brownish-black

(♂) the plumes maroon-brown with blonde reflections, the basal joint with whitish scales; nape light yellow; eyes with a whitish border. Thorax with brassy or golden tomentum, but without any special ornamentation; pleuræ speckled white. Wings unspotted, but with some lighter specks; coxæ brownish-yellow with whitish specks; femora yellowish-white, except near the apex and base, above, where they are dark brown, with whitish specks at the base; a white knee-spot; tibiæ brownish-black, except for a very narrow ring at the apex of yellowish-white, which unites with the basal ring of the first tarsal joint; tarsi brownish-black with broad rings involving two joints on the upper articulations and narrower ones on the lower, the last joint being entirely light coloured. In the male the fore tarsal claws unequal, the larger with an additional tooth; the middle claws appear to have the same characters, and the hind claws are the smallest, equal and simple; in the female the claws are all simple and equal, those of the hind legs being the smallest. In these details the species resemble *C. pulchripalpis*. Abdomen chocolate-brown with straw-coloured basal bands, narrow in the middle, but expanding laterally with triangular spots with the apex behind; venter generally whitish. Length, including the proboscis, 7-8 mm.

Habitat.—As yet has only been found in Italy.

68. **CULEX PULCHRIPALPIS**, Rondani.

Wings unspotted; tarsi with white rings involving the contiguous parts of two joints (on the hind legs alone), the other tarsi only minutely dotted. Thorax unadorned? has some brassy tomentum; abdominal segments with basal light bands.

Description from Ficalbi, "Venti Specie de Zanzare," p. 172.—Based on a not too-well preserved specimen in Rondani's collection. Proboscis yellowish-brown; palpi ♂, about the length of proboscis, not obviously either clavate

or pointed, brownish with three obvious white rings, the first at the base of the third, the second on that of the fourth, and the third occupying the whole of the last joint. Antennæ with the basal joint adorned with white scales, the plumes maroon with blonde reflections; nape brazen-coloured? Thorax with brazen tomentum? the pleuræ grey speckled white; coxæ yellowish with whitish specks; femora yellowish-white at the entire base and beneath, except at the apex, above dark brownish with light specks, the apex dark brown, to which succeeds a white knee-spot; tibia brownish-black, but with a white ring at the apex, which combines with a similar ring on the base of the first tarsal joint; tarsi as above, the last hind tarsal joint being entirely white; abdomen chocolate-brown with white basal bands on the segments, rather narrower than the dark portions in the middle but expanding into white spots laterally. Length, including the proboscis, 7-8 mm.

Habitat.—Italy.

69. **CULEX MUSICUS,** Say, *nec* Leach.

Wings unspotted; tarsi black with the two last joints of the hind legs white. Thorax unadorned, purple-black with yellowish scales; abdominal segments brown with yellowish basal bands, and lateral spots of yellowish scales.

Description from Say, "Jour. Acad. Nat. Sci.," Philadelphia, VI., p. 149. Head dull honey-yellow; vertex blackish with yellow hair; proboscis and palpi black. Thorax purple-black, with yellowish hair or scales. Wings dusky; poisers white, a little dusky at the tip; tergum purple or violaceous, with a band at the base and large lateral spots on each segment of yellowish hairs or scales; feet black violaceous; coxæ and femora, except at the tip, whitish sericeous; tarsi with two terminal joints of the posterior pair white. Length over $\frac{1}{5}$ of an inch.

There is a species of the same name described by Leach,

"F. R.," p. 295, from Nice, but the description is so inadequate that it would be impossible to recognise anything by it, and as it has been found by no one else I fail to see the use of maintaining it, even as a nominal species.

Habitat.—Indiana

70. **CULEX DISCRUCIANS**, Walker.

Jaxthinosoma discrucians, Arribálzaga. — Wings unspotted; tarsi steely-purple with a white band on the fourth joint of the hind legs alone; dorsum of the thorax with reddish-grey scales; abdomen, steel-blue above with silvery scales and hairs on either side, especially on the first segment. Probably a synonym of *C. posticatus*, Wied.

Description (original), Walker, "Insect. Saunders.," p. 430. That quoted is from "L. A.," p. 53. *Vide* figs. 10, 11, 12, plate VI. (♀ and ♂).—Blackish, somewhat steely. Head clothed behind and below with pale golden scales; antennæ fuscous; proboscis dark steely; palpi of the ♂ much longer than the proboscis, with an apical brush; those of the ♀ dark steely with the last joint large and oblong. Thorax with dark fawn-coloured scales above, with greyish-golden scales below and on either side. Wings limpid with fuscous scales, which are densely arranged in front and more sparely behind; first sub-marginal cell longer and narrower than the second posterior, their stems nearly equal, but while that of the first sub-marginal is barely half the length of the cell, the stem of the second posterior is quite as long as its cell. Legs dark steely, but with the femora broadly pale yellowish at the base; hind tarsi with the base of the fourth joint adorned with a pale yellow band. Abdomen steel-coloured above, the first segment with broad silvery fringes, the remainder not fringed but golden on either side; the venter with pale golden arcs. Length, 6 mm.

Habitat.—South America (Walker); Argentina, Arribálzaga.

71. **CULEX POSTICATUS,** Wied.

Wings unspotted; hind tarsi with the last joint white; thorax brown (denuded); abdomen clear steel-blue on the dorsum, ventrally with whitish incisures.

Description from Wied., "A. Z. I.," p. 9.—Brown with a steely reflex; the hinder tarsi with black cilia, and the apices white. Length 2 lines (German) ♀.

Wied., "D. E.," I., 43, 2. Antennæ, proboscis, and palpi brown, of a dull steely tint in certain lights; the thorax rubbed brown with a slight steely reflex; abdomen clear steel-blue; the incisuræ ventris distinctly whitish. Wings brown-scaled; halteres yellowish. Legs steel-blue; femora yellowish up to the apex; on the hinder legs the apices of the tibiæ and tarsi above and below are fringed with hairs which are dusky brown, or in certain lights of a steely tint; the apices of the posterior tarsi are clear white.

Habitat.—Mexico.

72. **CULEX ARTICULATUS,** Rondani (1872).

Wings unspotted; tarsal joints with basal white spots, but unbanded; thorax undescribed; abdomen brown with narrow lighter basal bands to the segments.

This is probably merely a sport of some species.

Description from "F. R.," p. 284.—Wings unspotted; tarsi without white rings; abdomen with narrow basal, dorsal bands of a lighter tint; palpi of the ♂ brown with their bases pale; joints of the tarsi brown, but with a distinct white spot at their bases, which, however are in no sense bands.

Habitat.—This species was described by Rondani alone from Italy, and is only known to Ficalbi by the specimens left by the former author. Ficalbi remarks that the basally spotted tarsi form a quite unique character not met with in other Mosquitoes.

73. **CULEX CASPIUS,** Pallas.

Wings unspotted; tarsi with pale bands, the position of which is not noted; thorax brown (?) with grey stripes; abdomen brown with yellowish basal bands (like *C. pipiens*); proboscis snowy.

Assuming the banding of the tarsal joints to be basal in position, this species finds its place with *C. conetrrens*, after No. 21, *C. cantans*.

Description from Pallas, "Reisen durch das Russisch Reich." Like *C. pipiens* but a little smaller, with the same voice and ferocity; colour greyish; the thorax with cinereous stripes; feet indistinctly banded; entirely covered with a slight pubescence, the wings also with delicate fringes on the veins and margin. Antennæ filiform in both sexes; proboscis simple, hirsute, longer than the thorax, its sheath snowy; the palpi very short, scarcely as long as the head, rather thick, in which points it most differs from the common gnat.

There is in the British Museum a series of specimens thus named from Finmark; in none of them can any banding of the tarsi be distinguished and it is difficult to see how they differ from *C. pipiens*.

Habitat. — The marshes near the Caspian Sea; treacherous, very common and numerous.

74. **CULEX VAGANS,** Wied.

Wings unspotted. Tarsi with lighter bands, the position of which is not stated; thorax rather deep clear brown, lighter in the middle; abdomen brown with whitish incisuræ.

Description from Wied., "A. Z. I.," p. 545.—Fuscous; with the incisuræ abdominis and the joints of the legs white. Length 2⅓-3 lines (German) ♂ ♀.

The colour is a moderately deep, clear brown; middle of the thorax lighter; abdomen of the males less deep, coloured

at the apex. Legs yellowish in certain lights, but always with whitish articulations; the joints of the palpi and apex of the proboscis are also whitish in certain lights. Veins of the wings with brown scales which form absolutely no spots.

In the British Museum there is a specimen so named from Fou Chow. It is too much denuded to show any markings. In the wing both fork-cells are long and narrow, the posterior being but a trifle the shorter, as its stem is the shorter and its base lies internal to that of the anterior. The supernumerary and middle transverse veins are of about equal length and in one line; the posterior almost as long as these together and placed less than half its length internal to the middle transverse vein.

Habitat.—China.

75. **CULEX AUREOSTRIATUS**, Doleschall.

Wings unspotted; tarsi with white rings, whose position on the joints is not noted; thorax black, with three parallel median, and two lateral oblique golden lines; abdominal segments black with white apical bands; proboscis upturned.

This species appears to be near the group of species including *C. Bancroftii*, *C. mosquito*, &c., and, assuming the tarsal banding to be basal on the joints, would come after No. 18, *C. vitatus*. It also bears some resemblance to *C. toxorhynchus*, as far as the very incomplete description of that species extends.

Description from Doleschall, "Natuurkundig Tidsch. voor Neder. Ind.," Deel XIV., p. 385.—Black, the back of the thorax marked with five glittering golden striæ, of which three are parallel, and an oblique one either side; abdominal segments bordered white; wings pellucid with black scales on the veins; hinder tarsi elongated, spotted white. Length $1\frac{3}{4}$ lines (Dutch).

♀.—The proboscis relatively large, straight, porrect, curved upwards. The antennæ and eyes black, the back

of the head grey. The thorax not very high, but moderately broad, black, with three equally broad, parallel, longitudinal stripes reaching from the anterior border to half the length of the thorax and of a glittering golden tint; and behind these a pair of similar but oblique lines extending from near the middle line, obliquely outwards and forwards, parallel with the hind border of the thorax. The abdomen black, cylindrical, with a bluish lustre; the hind border of each segment pure white, broader on the sides than in the middle. The legs a little hairy, slender and black, the hindmost pair much longer than the anterior legs, with four white bands on their tarsi; the upper half of the hind femora pure white. The wings as long as the abdomen, the veins black scaled.

Habitat.—Amboina, in dwelling rooms

76. CULEX WILLISTONI, Mihi.

Culex Sp., near *annulatus*, Williston.

Wings unspotted; tarsal joints with white rings, of which the position is not defined; thorax dorsally brown with white tomentum which forms two short lateral lines behind; abdomen with six conspicuous basal bands to the segments; proboscis black, with a white ring beyond the middle.

This species is suspiciously like *C. tæniorhynchus*, and almost certainly belongs to the same group. It differs in the abdominal rings being basal instead of apical on the segments, and in the adornment of the thorax.

Description from Williston, "North American Fauna," Washington, 1893.—*Female.*—Dark brown or black, the occiput covered with white and brown tomentum; palpi black, at the tip silvery; proboscis black, with a white ring beyond the middle. Antennæ black; dorsum of the thorax covered with brown and white tomentum, the white towards either side posteriorly forming two slender lines, abbreviated anteriorly; pleuræ with white tomentum; abdomen deep brown, with six conspicuous rings of white tomentum on the anterior part of the segments, the ground colour under

them yellow; on the second segment a white tomentose spot in front. Legs nearly black, the base of all the femora yellowish; on the outer side of the femora in large part, and along the whole inner side of the legs, as also moderately broad rings at the articulations of all the tarsal joints, white. Wings nearly hyaline; tomentum blackish, distributed nearly evenly on the veins. Length 6 mm.

One specimen, Argus Mountains, California, April. This species is closely allied to *C. annulatus* (Meig.), which occurs in the Western regions and in Mexico, but seems to differ in the evenly distributed tomentum of the wings.

77. **CULEX VARIEGATUS,** Doleschall, *nec* Schrank.

Wings unspotted; terminal tarsal joints white; thorax black, with a fine white median longitudinal stripe, and a fine white border to its dorsal plane. Abdomen with white bands on the last three segments (position unnoted) and with white lateral spots.

Description from Doleschall, "Natuurkundig Tidsch. voor Nederland. Ind.," Deel XVII., p. 77.—Black with the dorsal aspect of the thorax marked by a very thin white line, and encircled with snow-white spots about its middle; abdomen and legs spotted white; wings blackish piloso-squamose. Length $1\frac{1}{2}$ lines.

Black, elegantly marked with snow-white, the body almost bare. The eyes black, a white streak along the vertex. The thorax oval, moderately high, its dorsal plane surrounded with a fine white border, with a fine white longitudinal stripe in its midst; the pleuræ speckled white; the abdomen of the usual shape, with a fine transverse white stripe on the three last segments, and spotted white along the sides. The legs hairless, slender, with white bands; the tips of the tarsi white. The wings blackish, with black scales on the veins.

Habitat.—Amboina. One of the most troublesome Mosquitoes throughout the year; common in houses.

78. **CULEX FORMOSUS,** Walker.

Wings unspotted; tarsal joints with white rings, (position not noted); thorax deep red-brown, with four silvery stripes, the inner pair straight and narrow, the outer broad and curved; abdomen red-brown with silvery spangles.

Assuming the banding of the tarsal joints to be basal, this species would be placed after No. 24, *C. Kounoupi*, Brullé.

Description from Walker, "List," p. 4.—Deep red-brown; head much adorned with silvery spangles, as is also the thorax, where they form four stripes, of which the inner pair are straight and narrow, and the outer broad and curved; abdomen also adorned with silvery spangles; proboscis black; antennæ brown; eyes dark red. Legs brown, beset here and there with silvery marks; knees and the rings on the tarsi silvery. Wings somewhat grey, veins brown, very thickly scaled; halteres yellow. Length of the body 2 lines; of the wings 4 lines.

Habitat.—Sierra Leone.

79. **CULEX BIPUNCTATUS,** R. Desvoidy.

Wings unspotted; tarsi ringed with brown, and yellowish; thorax dorsally dark red, with two silvery spots in front, the pleuræ paler; abdomen pale yellow, with a median brown line.

Assuming the tarsal adornment to correspond, this species would be placed after *C. penicilaris*, Rond., No. 65.

Ficalbi naturally regards this species as of doubtful validity.

Description from "F. R." p. 272.—Proboscis yellowish, with the apex brown; palpi of the ♂, yellowish, faintly banded with brownish. Antennæ brown; thorax with the dorsum dark red and the pleuræ lighter, with two silvery spots in front; femora pale yellow; knee yellowish; tarsi

ringed with brown and yellowish; dorsum of the abdomen pale yellow, with a median blackish line. Length 4 lines.

Habitat.—France, but mentioned by Desvoidy and Macquart only, the latter apparently only on the authority of the former.

80. **CULEX CONTERRENS,** Walker

Wings unspotted; tarsi with lighter bands, the position of which is not noted. Thorax fuscous with a testaceous stripe. Abdomen wanting. General coloration tawny.

Assuming the banding of the tarsal joints to be basal, this species would find its place after No. 21, *Culex cantans.*

Description from Walker, "Insecta Saundersiana," p. 427.—Brown; proboscis and palpi tawny with black tips, the former stout, straight, pubescent, as long as the head and thorax. Antennæ black, tawny at the base. Thorax with a testaceous dorsal stripe; pectus testaceous. Abdomen wanting. Legs tawny, pubescent, very stout; tips of the femora and tibiæ blackish; tarsi blackish, with whitish bands. Wings greyish, brownish towards the costa; veins brown. Length of the body 4 (?) lines, of the wings 6 lines.

Habitat.—United States.

81. **CULEX NERO,** Doleschall.

Wings unspotted; tarsi with white bands the position of which is not defined; thorax with some black longitudinal streaks (?); abdomen unbanded black (?).

Description from Doleschall, "Natuurkundig Tidsch. voor Neder. Ind.," XIV., p. 383.—Black, with the eyes metallic green; wings with the veins blackly piloso-squamose, black along the anterior margin; legs bare, black, with white spotted joints. Length 1½ lines (Dutch).

Almost entirely black; the eyes dark green. The antennæ longer than the head and thorax in the male, thickly clothed with feathery hairs, the last joint out-

turned. The proboscis rather long; the palpi curved upwards and outwards, clothed with long hairs. The thorax high, oval, black, with some darker longitudinal streaks (*sic*). The abdomen cylindrical, armed with long hairs on either side. Legs moderately long, but as slender as hairs, black, hairless, with a white ring on each joint. The wings as long as the abdomen, scaly, black along the anterior border.

Habitat.—Middle Java, at Gombong, during the dry season, very numerous in dwelling-houses, and extremely troublesome.

82. **CULEX PARVUS,** Macquart (1834).

Description from "F. R.," p. 272.—Wings unspotted; tarsi ringed whitish; for the rest, like *C. pipiens;* length 2 lines.

The above species must practically remain merely nominal, as the description is quite inadequate to identify it definitely with any particular species.

Habitat.—France (Bordeaux).

83. **CULEX NICAENSIS,** Leach (1825).

Wings unspotted; tarsi cinereous, with grey rings (*sic*). Thorax unadorned, dark brown. Abdomen brown, with distal cinereous rings to the segments.

Obviously a purely nominal species, the description being not only inadequate, but absurd, as "cinereous" rings could hardly be distinguished on "grey" tarsi.

Description from "F. R.," p. 271.—Head and thorax dark brown; legs cinereous, with the tarsi grey-ringed; abdomen dark brown, with all the segments bordered behind with cinereous. Length 10 mm.

Habitat.—Leach describes this species as common in Nice, but Ficalbi has not met with any Italian gnat answering to the description, which is obviously inadequate.

84. **CULEX CONOPAS,** Frauenfeld.

Wings unspotted; tarsi with white bands, the position of which is not defined; thorax impure ochreous, rather lighter behind and at the sides; abdomen unbanded (?), dark ochreous (?).

Description from "Verhand. Zool. Bot. Ges." Wien, XVII., p. 451 (1867).—Impure ochreous, the upper side somewhat darker; the thorax appearing somewhat lighter behind and at the sides; eyes (in the dry state) black. Antennæ, palpi, and proboscis yellowish, the last brown for the apical third; the palpi also brown at the tip, and appear, in certain lights, glistening brown; the flagellar joints of the antennæ with one or two auditory bristles. Legs ochreous, with a silvery lustre in certain lights; tarsal joints somewhat darker, with white rings. Wings quite limpid, ferruginous on the anterior border; all the veins and the hinder border thickly fringed with brown scales. Length 3·1 mm. (♀).

Habitat.—Obtained in the China Seas, but may possibly have gained access to the ship elsewhere.

85. **CULEX ANNULITARSIS,** Macquart.

Wings unspotted; tarsi with white decoration; thorax unadorned, fuscous (?); abdomen unbanded, fuscous.

The description of this species is entirely inadequate, but its insular habitat may lead to its identification with some local species.

Description from Macquart, "D. E.," Suppl. I., p. 8 (1848).—Fuscous; tibiæ white-ringed; hinder metatarsi whitish, with fuscous rings. Length 2 lines (♀). Legs brown; femora with whitish bases; hind tibiæ with a large whitish ring before the tip; first hind tarsal joints whitish, with a small brownish ring.

Habitat.—Mauritius.

86. **CULEX ZONATIPES,** Walker.

Wings unspotted; tarsi with four white bands, the position of which is not defined; thorax and abdomen unadorned (?), ferruginous (?).

Description from "Proc. Linn. Soc.," V., p. 229.—Very nearly allied to *C. impatibilis*, but distinct.

Male.—Ferruginous; proboscis about half the length of the body; legs brown; femora pale at the base; knees white; tarsi with four broad white bands; wings cinereous; veins black, fringed. Length of the body 2½ lines; of the wings 4 lines.

Habitat.—Dorey, in New Guinea.

87. **CULEX ALTERNANS,** Westwood.

C. alternans, Westwood "Ann. Soc. Ent. France," Vol. IV., 1835, p. 681; "Trans. Ent. Soc. Lond.," Part III., 1881, p. 384.

Wings unspotted; tarsi with white rings, the position of which is undefined; thorax brownish (?), unadorned (?); abdomen with white bands, the position of which is not stated.

A very ill-defined species.

Description from "S. A. C.," p. 1,726.—Pale brownish; abdomen ringed with white; wings hyaline; veins, especially the costal, reddish, adorned with brown scales, except in the stigmatic region, where white scales appear, with others with black and white arranged alternately; legs reddish, with brown scales; femora before the apex, towards the tibiæ and behind the middle, with the genua and tarsi ringed with white. Length of the body (proboscis excluded) 4 lines: expanse of wings 8 lines.

Habitat.—New Holland. Hopean Mus., Oxford.

88. **CULEX PUSILLUS,** Macquart.

Wings unspotted; tarsi uniformly coloured; thorax blackish, ornamented with whitish lines; abdomen dark brown, with basal white bands to the segments. Legs pale yellow.

Description from Macquart, "D. E.," 4th Suppl., p. 9.—Blackish; the thorax ornamented with whitish lines, and the legs yellowish. Length, 1½ lines (♀). Proboscis, palpi, face, frons, and antennæ black; metathorax of a pale yellow; abdomen brownish-black, with whitish incisions, which, however, are often but little distinct. Legs pale yellow; halteres pale. Wings (when denuded) clear, with the base and external border yellowish.

Habitat.—Egypt. From M. Bigot. Perhaps a variety of *C. pipiens.*

89. **CULEX IMPUDICUS,** Ficalbi (1890).

Wings unspotted; tarsi uniformly nearly black; thorax dark brownish-grey, with two longitudinal, brassy lines behind; pleuræ white spotted; abdominal segments dark, with narrow white basal bands. Claspers of male exceptionally large.

Description from F. R., p. 285.—Proboscis nearly black; palpi of the ♂, pointed, surpassing the proboscis by the length of the entire last joint, together with the end of the penultimate, like those of the ♀, they are nearly black. Antennæ in both sexes, with the verticils nearly black, and the stem with alternate white and black rings, the latter being the narrower; the basal joint nearly black, bordered with white scales. Eyes metallic green, with margins of yellowish-white tomentum. Nape greyish-brown, but lighter than the thorax, owing to the presence of yellowish hairs. Thorax very dark grey-brown dorsally,

with two brassy, longitudinal stripes behind, but at the periphery, immediately at the level of the wings, it is lighter; ground colour of the pleuræ grey, with spots formed by groups of white scales. Wings rather fuliginous, especially in the ♀; fourchettes with their branches a little longer than their stems, especially the anterior, the stem of which is rather shorter than that of the posterior; halteres yellowish-white, with blackish spots at the upper extremity of the peduncle. Legs with the hips grey, with spots formed of whitish scales; femora dark brown above, and beneath almost entirely leaden white, and browned towards the end; knees with a minute white spot; tibiæ and tarsi nearly black. Abdomen with rather short, stiff brown hairs in the ♂, less abundant in the ♀. Dorsally the segments in the ♂ are nearly black, with a very slender white transverse line in front and behind, those of contiguous segments combining to form narrow bands, which, however, do not extend far laterally; in the ♀ the segments are pure black, with narrow basal white bands, and a very minute posterior white line, confined to the middle of the segments, besides which it expands in five segments, laterally into a triangular spot. Ventrally the abdomen is rich in brown hairs, but these are wanting in the ♂, except on the first two and the last segments, which are clothed with the leaden-white scales which form the fundamental colour of the abdomen; in the ♀ the venter is leaden-white scaled, and each segment has a lateral black spot at the base. The copulatory organs of the ♂ are cordiform, and exceptionally developed, and very hirsute, on which account the species has received its name. Length 6½-7 mm. in both sexes, but the ♂ is the more slender.

Habitat.—Sardinia. Not as yet found elsewhere. It does not attack man or animals.

90. **CULEX PUNCTOR,** Kirby.

Wings unspotted; tarsi uniformly dark testaceous; thorax dark chocolate brown with five nearly parallel lines formed of white scales; abdomen dark chocolate

brown, with narrow white basal bands on the dorsum of the segments; palpi unadorned.

Description from "Fauna Boreali-Americana, Insects," p. 309.—Body black; proboscis longer than the trunk; sheath black; valvules and lancets testaceous; palpi somewhat incrassated towards the apex; antennæ wanting. Wings white, iridescent, with testaceous nervures; without scales, hairs and fringe; legs testaceous.

The types of this very incompletely described species in the British Museum, which are fortunately in very fair condition, consist of two males, and show that it is really rather a finely adorned species with brilliant white markings on a very dark ground.

The head has the nape black, with distinct signs of white adornment. The proboscis, palpi, and antennæ are uniformly dark brown, the last densely plumose with dark-haired verticils which show a silvery lustre in certain lights. The thorax dark red brown, with five lines of brilliant white tomentum, viz., a fine median; two complete broad lateral, and external to these again a narrower pair of lateral lines incomplete in the middle. Legs testaceous, with the tarsi darker and without any signs of banding. Abdominal segments dark chocolate-brown with white basal bands, narrow in the middle, but so much wider at the sides as to form distinct backward extensions, sides of the abdomen fringed with long, rather light brown hairs; male claspers very long. The wings have the anterior fork-cell longer and narrower than the posterior, both cells being proportionately very short, with long stems. The posterior transverse vein is very short and placed a little internal to the middle transverse.

In spite of the fact that the original description is too inadequate to admit of any conclusion, Howard and Marlatt, "Household Insects of the U.S.," make this a synonym of *C. consobrinnus*, Desvoidy, together with *C. impatiens* and *C. pinguis*, Walker. From the last two species it is undoubtedly distinct, and I see no reason for thinking that it at all resembles *C. consobrinus*.

Habitat.—St. Martin's Falls, Albany River, Hudson's Bay. Two specimens taken in lat. 65° North.

91. **CULEX LINEALIS,** Skuse.

Wings unspotted; tarsi uniformly coloured; thorax brown, with four parallel golden scaled lines. Abdominal segments violet black with narrow ochreous basal bands.

Description from "S. A. C.," p. 1,747.—♀.—Length of antennæ 2·39 mm.; expanse of wings 4·06 × 1·13 mm.; size of body 5·08 × 1·01 mm. Antennæ brown, about five-sixths the length of the proboscis; first joint of scapus dull red-brown, with yellow scales; head brown, densely clothed with golden scales and hairs; proboscis uniformly violet black-scaled, about six times the length of the palpi; palpi uniformly violet black-scaled. Thorax brown, with four distinct lines and dense lateral borders of golden scales; the interstices bare, or nearly so; the two median lines are close and parallel, and though separate at the ends, are confused near the back; the outer ones also parallel, but quite distinct from them, and rather nearer the lateral borders; pleuræ brown, with a few rather indistinct patches of white scales and a small tuft of moderately long hairs under the origin of the wings; scutellum brown, with a continuation of the median yellow thoracic lines coalescent at the apex, beset with long golden hairs; metanotum brown; halteres ochreous. Abdomen not quite twice the length of the thorax, superior segments violet black-scaled, narrowly ochre-banded in front, while ventrally the ochreous portion is wide and the violet narrow. Coxæ and femora ochreous, the latter with some violet-black scales along the upper side and at the tip, except at the extreme apex; tibiæ and tarsi dark violet, the former somewhat ochreous at the sides and extreme apex, and the first two tarsal joints dimly ochreous at the base; hind tibiæ one-third longer than the metatarsi. Wings longer than the abdomen, hyaline, veins densely violet brown-scaled. Auxiliary joining the costa opposite the middle transverse, and a little before the tip of the hinder branch of the fifth longitudinal vein; middle transverse

rather indistinct, longer than the posterior transverse vein, placed beyond it twice the length of the latter; first submarginal scarcely longer but considerably narrower than the second posterior cell, its base a little beyond that of the latter; anterior branch of fifth longitudinal as in *C. Macleayi* (No. 116).

Habitat.—Knapsack Gully, Blue Mountains; Hexham and Wheeney Creek, N.S.W. (Skuse). October to January.

92. **CULEX SKUSII,** Mihi.

Culex sp., near *C. ciliaris. L. Skuse.*

Wings unspotted; tarsi uniformly coloured; thorax orange-brown, with four lines of golden hairs, as in *C. Bancroftii.* Abdominal segments violet-black, with narrow ochreous basal bands. Distinguished from the preceding by certain trifling differences of wing venation and its lighter colour. The resemblance to *C. ciliaris* appears much less marked.

Description from "S. A. C.," p. 1748.—Length of antennæ ♂ 2·14 mm.; ♀ 2·54 mm.; expanse of wings ♂ 4·06 × 1·01 mm.; ♀ 4·56 × 1·13 mm.; size of body ♂ 5·58 × 1·01 mm.; ♀ 5·58 × 1·18 mm.

♂ and ♀ —Antennæ light brown; scapus ochreous, except apical half of second joint; in the ♂ more than three-fourths the length of the palpi, basal half of flagellar joints, saving the last whitish; in the ♀ somewhat longer than the proboscis. Head brown or ochreous brown (when denuded), densely clothed with golden hairs and scales. Proboscis ochre-brown scaled, dark violet at base and towards the end; in the ♀ about seven times the length of the palpi. Palpi of the ♂ light ochre-brown, with faintly violet scales, the fourth joint with a pale naked yellow ring at the base; in the ♀ violet-black-scaled. Thorax generally orange-brown, sometimes darker (when denuded) densely golden scaled, in fresh specimens, transversed by four fine naked lines, arranged as

in *C. Bancroftii* (No. 14, p. 221); sides and back of thorax densely beset with long golden hairs; pleuræ orange-brown, frequently very pale, with a few small, often indistinct, white scaled patches; scutellum yellowish or brownish, golden scaled and fringed with long golden hairs; metanotum ochreous. Halteres pallid or ochre-yellow, the club more dusky. Abdomen more than twice the length of the thorax in the ♂, shorter in the ♀; dorsally dark violet-scaled, each segment narrowly ochre-banded in front; venter whitish-scaled; external genitalia ochreous, densely haired. Legs violet-brown scaled, the femora with whitish scales, and slightly at the base, the latter and the tibiæ very slightly ochre-tipped; tibiæ and tarsi with a pale ochreous reflection beneath; coxæ brownish-yellow, with white scales. Wings longer than the abdomen, hyaline, veins densely violet-brown scaled. Auxiliary, joining the costa opposite the tip of the hinder branch of fifth longitudinal vein; middle about equal to the posterior transverse vein, placed twice the length of the latter in front of it; first sub-marginal longer, and somewhat narrower than the second posterior cell, its base opposite that of the latter in the ♂, slightly before it in the ♀; anterior branch of fifth longitudinal originating at a point nearer the origin of the second than to the tip of the sixth longitudinal vein.

Observation. — Individual specimens of this species apparently vary somewhat in colour, as nearly every reference to colour is in the original, expressed by several nearly synonymous words. Considerations of space render it impracticable to give these in full. The same remark applies to a less extent to many others of the species described by this author.

Habitat.—Widespread in Australia. Found in towns, throughout the year, but most annoying during the summer.

93. **CULEX IMPATIENS**, Walker.

Wings unspotted; tarsi unbanded; thorax adorned with three lighter brown stripes, the median one of which is slender and forked towards the tip. Abdominal segments brown, with hoary (♂), or yellow (♀) basal bands.

Description from Walker, "List," p. 5.—♂—Body dark brown, clothed with pale brown hairs. Antennæ and proboscis black; thorax with three pale brown stripes, the middle one slender and forked towards the tip. Abdomen with a hoary band on the fore border of each segment; its sides clothed with long hairs; femora brown, with black tips; tibiæ dark brown; tarsi black. Wings colourless; veins brown; halteres very pale brown.

♀—Body red, clothed with yellow hairs. Head thickly covered. Thorax with three brown stripes. Abdomen brown, with a yellow band at the fore border of each segment. Legs pale brown; tips of the femora and tibiæ yellow; tarsi dark brown. Wings colourless; veins brown; halteres yellow, with brown tips. Length of the body 3 lines; of the wings 6 lines.

This is a large species. In the present condition of the types, the denuded thorax is dark brown, and there are only remains of the original adornment. The wings have the anterior fork-cell long and narrow, its stem shorter than that of the posterior, which is broad, with divergent branches. The posterior and middle transverse veins are in one oblique line, the supernumerary transverse joining the latter at an open angle.

Howard and Marlatt in "Household Insects of the U. S." make this species a synonym of *C. consobrinus* (Desvoidy), but both descriptions are too brief to admit of forming any useful opinion on such a point unless the types can be compared. Both certainly much resemble *C. pipiens, L.*

Habitat.—St. Martin's Falls, Albany River, Hudson's Bay Territory.

94. **CULEX PUNGENS,** Wied.

C. pungens, Macquart, Col. Jardin des Plantes.

Wings unspotted; tarsi uniformly coloured; thorax bright red-brown, with two clear yellowish lines in certain lights. Abdomen fuscous, with basal (?) yellowish incisuræ.

There is a specimen labelled *C. pungens*, Macquart, in the Jardin des Plantes, which corresponds fairly with Wiedemann's description. In this the thorax does not show the lines mentioned, but it is rather rubbed, so they may have disappeared. I think the banding of the abdominal segments is basal, but owing to mildew, it is not easy to be sure. Proboscis dark, antennæ light brown. Wing; the first submarginal cell is very long and narrow; the second posterior short and broad; the stems of these cells are both short, but that of the anterior is much the shorter; the second longitudinal vein springs obliquely from the first, without the intervention of a transverse piece; the middle and supernumerary transverse veins are both equally short, the posterior is much longer, and placed a good deal internal to them. The scales of the veins are dark brown, those of the internal fringe being, however, a little lighter.

Description from Wied., "A. Z. I.," p. 9.—Ferruginous; with the abdomen fuscous, and the incisuræ yellowish; 2-2¼ lines (German) ♀.

Antennæ, palpi and proboscis brownish-black, the last, yellowish below. Thorax bright red-brown, with, in certain lights, two small clear yellowish lines; pleuræ yellowish, passing into white behind; abdomen brown, with clear yellowish segments; the two or three last segments with yellowish stripes on both sides. Wings unspotted, with brown-scaled veins; halteres yellowish.

Habitat.—New Orleans.

95. **CULEX ATRIPES,** Skuse.

Wings unspotted; tarsi uniformly coloured; thorax dark violet, with prothoracic lobes; the pleuræ and a spot in front of the wings silvery. Abdominal segments not banded, but with a silvery spot on either side. Knees with a minute spot.

Description from "S. A. C.," p. 1750.—♀—Length of antennæ 1·76 mm.; expanse of wings 3·04 × 0·76 mm.; size of body 3·81 × 0·76 mm. Antennæ black, a little

shorter than the proboscis; first joint of scapus with hoary reflection. Head densely violet-black scaled, the eyes bordered with a fine silver-scaled line. Proboscis six times the length of the palpi, both uniformly violet-black scaled. Thorax (when denuded) glistening black, light bronze scales, densely haired above the origin of the wings and behind; prothoracic lobes, pleuræ, and an oblong spot before the origin of the wings, silver-scaled; scutellum ochreous, violet-brown scaled above, and fringed with long hairs; metanotum red-brown. Halteres ochreous, the club and distal part of stem rather brown. Abdomen about twice the length of the thorax, uniformly violet-black scaled above, each segment with a white patch at the sides; venter densely silver-scaled. Legs violet-black scaled, the coxæ more or less silver-scaled, and the femora dusted on their basal half with pale scales, which have a light bronzy reflection, in certain lights. In the hind legs the metatarsi nearly one-seventh longer than the tibiæ. Wings longer than the abdomen, clear pellucid, with a slight brownish tint, veins densely violet-black scaled; violet and purple reflections. Auxiliary vein joining the costa at a point opposite midway between the middle and posterior cross-veins, and considerably before the tip of the hinder branch of fifth longitudinal; middle considerably shorter than the posterior transverse, and placed about twice the length of the latter beyond it; first sub-marginal much longer and scarcely narrower than the second posterior cell, its base lying somewhat before the latter; anterior branch of fifth longitudinal originating opposite a point about midway between the origin of the second and tip of the sixth longitudinal.

Observation.—What appears to be a ♂ specimen from Mossman's Bay, near Sydney, has the femora and tibiæ tipped with white scales, and the tarsi with light reflections, when viewed at a certain obliquity.

Habitat.—Homebush (Masters); Sutherland, and Knapsack Gully, N. S. W. (Skuse).

96. **CULEX ALBIFASCIATUS,** Macquart.

C. vittatus (?) Philipp, "Verh. Zool.-Bot. Gesell.," XV., 596 (1865), *nec* Bigot. *Ochlerotatus albifasciatus* Arribálzaga, "L. A.," p. 44.

Wings unspotted; tarsi unbanded; thorax reddish-fawn colour, with a median stripe and broad lateral bands of golden yellow. Abdomen not banded, but with a median longitudinal greyish stripe (♀), or dusky, with a median whitish stripe formed of consecutive triangular patches (♂). The proboscis upturned.

I have examined the type in the Jardin des Plantes. It is rather a large species, and corresponds well to Arribálzaga's description, given below. The decoration of the abdomen is very characteristic, but the decoration of the thorax cannot now be made out. The stem of the first sub-marginal cell is very slightly longer than that of the second posterior, and the former cell is a little longer and distinctly narrower than the latter cell. There are no extensions of either the second or third longitudinal veins inwards. The resemblance to *C. nemorosus*, mentioned by Macquart, is certainly not striking. Arribálzaga's Genus has not been adopted in the present work.

Description from "L. A.," p. 44.—Macquart's description is omitted as it contains no additional points.—Fuscous or dusky black; mesonotum with chestnut or fawn-coloured scales, adorned with a longitudinal median line, and with lateral margins of golden yellow; abdomen black, with a cinereous median longitudinal line. Legs pale yellow; tibiæ and tarsi fuscous. Head with silky yellow scales, and sparse fuscous hairs. Antennæ and their verticils fuscous in both sexes; proboscis dusky black; palpi nearly black, short (♀) or long, fuscous, with dense long fuscous villosity, almost tufted towards the apex (♂). Thorax chestnut or fawn above, with a median longitudinal line and a broad band on either side of golden yellow, bristly in front and behind; pleuræ frosty ash-grey; scutellum fawn-coloured, with fuscous hairs. Coxæ with yellowish-grey scales; femora pale yellow, gradually darkening to fuscous at the

apex; tibiæ and tarsi fuscous with scanty grey scales. Wings hyaline, but with dense fuscous scales. Abdomen black above, marked with a greyish-white longitudinal, median stripe, and greyish-white towards the sides and below, with a few fuscous hairs (♀), or elongate, parallel, dull fuscous above, with a greyish-white median line, formed of obtriangular spots, grey below, and with long woolly fuscous hairs on either side (♂). Length 5-6 mm.

Habitat.—Brazil (Macqt.); Chili (Phil.); Buenos Ayres, and several localities in Argentina (Arribál.), in which latter region it is very common and troublesome.

97. **CULEX FATIGANS,** Wied.

Wings unspotted; tarsi uniformly brown; thorax with a median and two lateral dark lines, the latter much the most conspicuous, Abdomen at segments brown with basal whitish bands; knees unspotted,

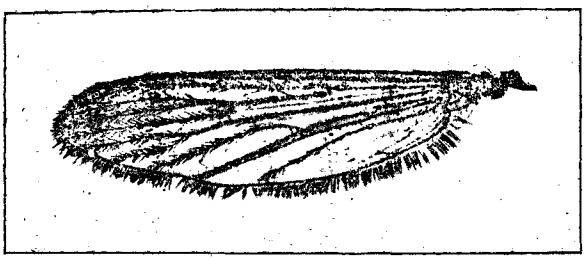
I identify this species with the "grey" Mosquito in which Major Ross, I. M. S., observed the intermediate stage of *Proteosoma Labbé*, an avian *hæmatozoon*.

Description from Wied., "A. Z. I.," p. 10.—Fuscous; the thorax with two stripes; the abdomen white-banded; the legs yellowish. Length 2 lines.

Antennæ brown; palpi and proboscis yellowish; brownish at the apex in certain lights; lower part of the face white; thorax brown, with two very dark linear stripes; pleuræ yellowish. Every segment of the abdomen has a white band at its base. Wings limpid with brown scales, and with a fringe, whitish in certain lights, on its inner edge. The legs, in certain directions, appear whitish.

This species closely resembles *C. pipiens L.*, but is much smaller, and may be further distinguished at a glance by the dark lines on the dorsum of the thorax, which are entirely wanting in *C. pipiens*, alike in fresh and rubbed specimens. In the denuded thorax, the difference is even plainer, the ground colour in this species being of the tint of old ivory, with a median and two lateral brown lines,

the latter being much the most conspicuous. In *C. pipiens*, on the other hand, the denuded thorax is black without markings. In addition, the lighter basal bands of the abdominal segments are much narrower, and not so yellow. Lastly, in the wing of *C. fatigans*, the second and third longitudinal veins have distinct scaly extensions running back into the first basal cell, beyond their points of origin from the first longitudinal and supernumerary transverse veins respectively, while these spurs are quite wanting in the wing of *C. pipiens*.



Wing of *Culex fatigans*. Wied.

In a fresh specimen recently obtained the thorax is densely covered with golden scales, the dark lines being bare, very narrow and indistinct. The difference from *C. pipiens* is more apparent in the denuded than in the undenuded thorax.

Habitat.—The East Indies.

98. **CULEX PALLIPES,** Meigen (1838).

Wings unspotted; tarsi without bands; thorax reddish brown with two dark stripes; abdomen brown with basal white bands to the segments; knees unspotted; general coloration flaxen.

There are six of Meigen's specimens of this species in the Jardin des Plantes, three from Germany and three from Egypt.

The bands of the abdominal segments are basal in position, and are quite prominent in some specimens, but in others not very noticeable. I was unable to make out more than a trace of the darker lines of the thorax in many of the specimens. In the wing the first sub-marginal cell is very long and narrow, its stem being exceptionally short; while the second posterior cell is short and broad.

I am strongly inclined to think that this is identical with *C. fatigans* (Wiedemann).

There is another *C. pallipes* of Macquart, the description of which does not correspond to that of the present species, but as the probability seems that it was subsequently described it has been necessary to rename it *melanorhinus*.

Description from "F. R.," p. 290.—Proboscis light yellow, with the distal third brown; thorax dorsally reddish-brown, with two dark stripes. Legs pale yellow, but with the tarsi brown; abdomen with the dorsum brown, but with the incisuræ of the segments lighter so as to form barely perceptible cross-stripes. Length 2 lines.

The description is so insufficient that it is doubtful if it can be maintained as a distinct species.

Habitat.—Meigen described the species on two ill-preserved ♀ specimens from Spain, and no one else has noted it except Gimmerthal from Russia. Meigen also obtained it from Egypt.

99. **CULEX ORNATUS**, Meigen (1818).

C. equinus, Meig., 1804.

Wings unspotted; tarsi uniformly nearly black; thorax yellowish white with two converging sub-median streaks, and often two others at the sides behind; abdomen dark brown with silvery basal bands, last segment all white.

Description from "F. R.," p. 285.—Proboscis nearly black; palpi of the same colour, with rather long hairs and three white spots in the ♂; antennæ nearly black in both sexes; tomentum of the nape greyish or yellowish; thorax dorsally yellowish white, with two converging,

blackish streaks, and frequently two others more laterally behind; pleuræ with silvery spots. Wings brown; legs with the coxæ light yellow at the base and beneath, but above and in all their distal portion nearly black, knees white; tibiæ and tarsi nearly black. The abdomen has dorsally brownish black and silvery bands, the latter at the front (or middle?) of the segments, which are sometimes interrupted in the middle; last segment entirely white. Length 6½-8 mm.

The type in the Jardin des Plantes is represented only by an unoccupied pin. Ficalbi in his "Venti Specie de Zanzare," (1899), gives an elaborate description of this species, but as he states that the thorax has no special ornamentation it is doubtful if he refers to the same species. In the British Museum is a specimen labelled *C. ornatus*, Hoffmnsg., which corresponds fairly to the original description. In this there are still traces of the markings of the thorax and abdomen as described by Meigen, there are white knees, and the wing has both the fork-cells long and narrow with parallel sides, the anterior, however, being much the longer and narrower and its stem a little shorter than that of the posterior.

Habitat.—Germany (Meig.); Austria (Schiner); England (Stephens); Scandinavia (Zetterstedt); Russia (Gimmerthal). Ficalbi has not met with it in Italy.

100. **CULEX FUSCANUS,** Wied.

Wings unspotted; tarsi unbanded; thorax rather dusky, with grizzly hairs arranged so that the ground colour shows through as four (darker) lines. Abdominal segments dusky with light grey apical bands.

Description from Wied., "D. E.," p. 9.—Somewhat dusky, thorax faintly banded; abdomen banded grey. Length 3½ lines. ♂, ♀.

Antennæ rather dusky; palpi yellowish, beneath, with two white points, fuscous and downy, with the down longer and less close, before the apex; thorax also rather dusky,

with grizzly hairs arranged in such manner that the ground colour appears as four linear stripes, or at least shows so in somewhat rubbed specimens; abdomen, of the same tint as the thorax, &c., each segment having a grey apical band. Wings somewhat yellowish at the costa. Legs yellowish-fuscous.

Habitat.—East India.

Also found at Malacca and Singapore, and at Sarawak, Borneo, by Wallace. Walker, "Proc. Linn. Soc.," I. (1857), pp. 4 and 105.

101. **CULEX SAGAX,** Skuse.

Wings unspotted; tarsi uniformly violet-brown; thorax clothed with golden and violet silky scales, traversed by three rows of brown hairs; a median ending in a bare space in front of the scutellum and a longer lateral pair. Abdomen violet-black with a sinuous ochreous band on the fore borders of the segments.

Description from "S. A. C.," p. 1744.—♀—Length of antennæ 2·39 mm.; expanse of wings 4·31 × 1·27 mm.; size of body 5·08 × 1·01 mm. Antennæ fuliginous, nearly the length of the proboscis; scapus more or less testaceous or ochreous, with a few white scales; head deep brown, with a dense covering of brown and golden scales and hairs; proboscis black, rather more than five times the length of the palpi; palpi black. Thorax piceous (when denuded), densely clothed with golden and whitish scales which give it a somewhat silky appearance, traversed by three rows of brown hairs, the latter extending from the collar to the scutellum, the middle one ending at a bare space in front of the latter; pleuræ deep umber-brown, with small patches of whitish scales; scutellum testaceous, clothed with whitish scales and long brown hairs; metanotum reddish brown; halteres ochreous. Abdomen nearly twice the length of the thorax, the segments violet-black scaled and bordered in front with a sinuous ochreous band; venter densely pale ochre-scaled; lamellæ of ovipositor deep brown, elongate;

coxæ red-brown, white-scaled; femora violet-black scaled, more or less dusted with pale ochreous, the former pale ochreous beneath and yellowish at the apex; tarsi violet-brown scaled with an ochreous reflection in certain lights. In the hind legs the tibiæ one-third longer than the metatarsus. Wings nearly the length of the whole body, hyaline, violet-brown scaled on the veins; auxiliary vein joining the costa exactly opposite the tip of fifth longitudinal's hinder branch; middle rather longer than the posterior transverse vein, placed rather less than the length of the latter in front of it; first sub-marginal cell scarcely longer and much narrower than the second posterior, its base a little beyond that of the latter; anterior branch of fifth longitudinal originating at a point nearer the tip of the sixth than to the origin of the second, reaching the posterior border opposite the middle of the second posterior cell.

Habitat.—Murrumbidgee, N.S.W. A day-flying Mosquito.

102. **CULEX DOLOSUS** (Arribálzaga).

Heteronycha d....., ----------, —. —., p. 56.—Wings unspotted; tarsi unbanded, pale reddish; thorax reddish with yellowish scales, and three dusky lines; abdominal segments dusky, with yellowish white basal bands and differs from the preceding in the form of the tarsal claws.

This species has been instituted in a separate genus by Arribálzaga, but this has not been adopted in the present compilation.

Description from "L. A.," p. 56.—Head testaceous, darker behind, with yellow scales and fuscous hairs; eyes black, with a very narrow, often scarcely distinguishable silvery margin. Antennæ fuscous or testaceous, the basal joint testaceous, those of the ♀, with fuscous hairs; of the ♂, moderately densely fuscous verticilate with the bases of all the joints whitish; proboscis generally testaceous (♀),

or fuscous (♂); palpi testaceous with slight fuscous pilosity (♀), or more or less testaceous at the base and fuscous at the apex, with long hairs (♂). Thorax testaceous above with yellow scales and three lines of fuscous hairs, the middle one fading off in front; somewhat frosty grey on either side. Wings hyaline with moderately dense fuscous scales. Legs pale testaceous, often with the tibiæ and tarsi fuscous; halteres pale testaceous; abdomen fuscous above, the segments with a basal yellowish white band, broadening laterally (♂), or with long fuscous hairs, and yellow below with a few fuscous scales (♀). Length, without the proboscis 4-5 mm.

This species closely resembles *C. flavipes*, but differs in the following particulars, which Arribálzaga regards as of generic value (*Heteronycha*). Antennæ fourteen jointed in the ♂, the penultimate longer than the last; thirteen jointed in the ♀. Palpi of the ♂, five jointed arcuate, filiform, longer than the proboscis; the first two very small, the third as long as the following two together, which last are subequal, all three being moderately plumose; those of the ♀, very short, the first three minute, obconical; the fourth longer than the rest together, and the last very small and conical; proboscis longer than the head and thorax combined, porrect, slightly dilated at the end. Legs long and slender; claws of the fore and middle legs unsymmetrical, the internal being smaller than the external, armed beneath, towards the middle with a sharp tooth; while those of the hinder legs are very small, equal, and barely bearded in the ♂; in the ♀, all equal, elongated and little curved; first tarsal joint longer than the tibia. Wings narrow, nearly lanceolate, the first sub-marginal cell longer than its pedicle, but the second posterior equal to its pedicle.

Habitat.—Buenos Ayres and Argentina.

103. **CULEX FLAVIPES**, Macquart.

C. flavipes, Macquart, "D. E." I., p. 35 (1838); Blanch, in "Gay., Hist. fis. and polit. Chili, Zool." VII., p. 332 (1852); Philipp, "Verhandl. Zool.-bot. Gesell.," XV.,

p. 595 (1865); "L. A.," p. 58 (1891); *C. serotinus*, Phil. "Aufzähl. Chil. Dipt.," p. l. (1865); *C. molestus*, Kollar, "Brasiliens vorz. läst. Insect.," p. 187 (1832); Walker, "Proc. Linn. Soc.," Lond., XVII., p. 331 (1837) *nec* Wiedemann (1828).

Wings unspotted; tarsi unbanded, dusky; thorax rufous with two dusky, submedian lines; abdominal segments reddish brown, with yellowish basal bands; legs yellow.

Description from "L. A.," p. 58.—Head testaceous, with black or fuscous pilosity; vertex with yellow scales between the eyes; proboscis fuscous with the base pale. Antennæ and palpi dull yellow, the former with fuscous verticils in the ♂, sparsely so in the ♀; the latter a little longer than the proboscis in the ♂, moderately clothed with fuscous hairs; the basal joint of the antennæ testaceous. Thorax rufous or testaceous above, sometimes dusky fawn with golden scales, but with yellowish fuscous hairs, especially behind; with two dusky grey lines in the middle, sometimes ill-defined; pleuræ mostly testaceous, sparsely cinereous or frosty white. Wings limpid with pale fuscous scales. Legs pale yellow with fuscous scales, the tarsi fuscous; claws very small, strongly curved, but without accessory teeth. Abdomen obscurely fuscous or reddish fuscous above, the bases of the segments pale yellow, clothed with whitish scales; below pale testaceous with frosty grey scales. Length, 4-6 mm (♂ and ♀).

The type in the Jardin des Plantes is in rather bad condition, most of the appendages being wanting. Proboscis rather pale-brown, venter black. There is no remaining trace of any abdominal banding. The middle and supernumerary transverse veins form a somewhat oblique straight line passing backwards and outwards from the second longitudinal vein, so that though the stems of the "fork-cells" are of almost equal length, the base of the anterior is the more internal. The anterior of the two cells is narrower and a little longer of the two. The posterior transverse vein is placed about twice its length internal to the middle transverse.

Habitat. — Chili (Macquart); Southern Provinces

(Blanch); Brazil (Koll.); Uraguay (Walker); Argentina (Arribál.)

104. **CULEX NEMOROSUS,** Meigen (1818).

Wings unspotted; tarsi unbanded; thorax yellowish brown with (often) four darker longitudinal lines. Abdominal segments with clear basal bands and no lateral spots; knees, pure white.

In the type in the Jardin des Plantes, the thoracic adornment is now by no means prominent. The abdominal bands are brilliant in the ♂, darker in the ♀, and in her the knee spots are by no means striking. The first submarginal cell is somewhat longer and narrower than the second posterior, both cells being rather short, and the stem of the former rather the longer, the base of the cell being placed a little further out.

Description from "F. R.," p. 284. *C. reptans,* Meig. 1804; *C. fasciatus,* Meig. 1804; *C. sylvaticus,* Meig. 1818. —Proboscis dark brown, as also the palpi in both sexes, and the antennæ, which however, in the ♂ have light coloured hairs at the point; eyes dark metallic green, with contours of white tomentum; ground colour of the nape brown, with yellowish tomentum. Dorsum of thorax yellowish brown, due to the presence of some yellow tomentum on a brown ground, and often four darker longitudinal lines can be made out; pleuræ speckled white. Wings brown, with the stem of the anterior fourchette longer than in other species, and equal to that of the posterior. Legs with the coxæ light yellow at the base and beneath, distally brown except for the knee-spot, which is brilliant white; the light abdominal bands are whitish straw colour. Length, 8½-10 mm.

Habitat.—Widely spread throughout Europe; faunistic authorities noting it from Lapland to Italy.

105. **CULEX GENICULATUS,** Olivier (1791).

Wings unspotted; tarsi uniformly blackish. Thorax cinereous with two blackish lines near the middle and two on the sides. Abdominal segments with distal light borders; knees distinctly white-spotted.

Description from "F. R.," p. 292.—Proboscis black; antennæ brown; nape cinereous; dorsum of the thorax cinereous, with two blackish lines near the middle line, and two on the sides. Wings clear (?). Legs with the coxæ white at the base and beneath, distally dark, but the knees are white; tibiæ and tarsi blackish. Abdomen dorsally brown with the borders of the segments whitish.

Habitat.—Paris (Olivier and R. Desvoidy).

106. **CULEX TERRITANS,** Walker.

Wings unspotted; tarsi unbanded. Thorax pale brown with three darker (?) very slender testaceous stripes. Abdominal segments with apical whitish bands.

Description from Walker, "Insect. Saunders." p. 428.—Pale brown; proboscis testaceous, slender, brownish at the tip. Antennæ brown, testaceous at the base, as long as the proboscis; thorax with three very slender testaceous lines; abdomen testaceous beneath, the segments dorsally with whitish hinder borders Legs testaceous, long, slender. Wings greyish; veins brown, slightly ciliated; halteres testaceous. Length of the body 3 lines; of the wings 6 lines.

There is no sign of tarsal banding in the type. The wings have the anterior fork-cell extremely long and narrow, its stem very short, the posterior being wide and short. The posterior is longer than the other transverse veins and placed distinctly internal to them.

Habitat.—United States.

107. **CULEX ÆSTUANS,** Wied.

Wings unspotted; tarsi dusky brown, usually uniformly, but occasionally with a trace of a band; thorax clear brown with a median darker stripe; abdominal segments nearly black with yellowish apical bands.

Description from Wied., "A. Z. I.," p. 11.—Thorax brown; abdomen fuscous, banded white; the legs fuscous with whitish articulations.—2½ lines, ♂, ♀. Antennæ yellowish; proboscis brownish black, with whitish joints; thorax moderately clear brown, with a single deeply-tinted stripe. On the hinder part of every segment of the brownish black abdomen is a clear yellowish white band. On the otherwise dusky brown legs the femora are yellowish, the colour, however, becomes browner near the apex; the extreme apex of the femora and tibiæ are yellowish white, which, however, does not markedly catch the eye. In one specimen there is a trace of a white band on the tarsi, but this is entirely wanting in the other five.

Habitat.—Brazil.

108. **CULEX CONCOLOR,** R. Desvoidy.

Wings unspotted; tarsi unbanded; thorax pale red with three indistinct brown lines; abdomen pale yellow with dark incisuræ, *i.e.*, apically lighter; wings with the veins nearly nude.

Description from Desv., "Essai.," p. 405.—Proboscis, palpi, and legs pale yellowish; antennæ brown; thorax pale rufous with three obscure lines; abdomen pale yellow, with the incisures of the segments dorsally brownish; legs darker brown. Wings almost limpid, very slightly yellowish, the veins almost nude. Length 4 lines ♂.

Habitat.—Unknown.

109. **CULEX LATERALIS,** Meigen (1818).

C. albopunctatus, Rondani (1872).—Wings unspotted; tarsi unbanded (?); thorax greyish white, with the sides and two converging lines blackish; abdomen black with lateral white points.

Description from "F. R.," p. 282.—Head greyish white; thorax as above; legs with the coxæ pale yellow, but brown at the apex; knees pallid; tibiæ and tarsi dark brown. Wings brown and the halteres whitish; abdomen, as above. Length 4 mm.

C. albopunctatus is stated to be from Italy. Ficalbi does not know it, and merely states in addition that the branches of the fourchettes of the wings are longer than their stems. He does not mention his authority further.

Habitat.—Meigen describes this species as from Austria, but Schiner did not meet with it; Stephens notes it from England but not Walker, and Gimmerthal from Russia. Ficalbi has not found it in Italy.

110. **CULEX RUBIDUS,** R. Desvoidy.

Wings unspotted; tarsi unbanded; thorax reddish with a black dorsal line; abdomen unbanded but with triangular lateral yellow spots; hind tarsi with white cilia.

Description from Desv., "Essai.," p. 404.—Antennæ brownish; proboscis yellowish with the apex brown; palpi brownish yellow; thorax reddish with a black dorsal line; abdomen brownish, with triangular yellowish lateral spots; hind tarsi with white cilia; wings brownish yellow with villous veins. Length 4½ lines (♀).

Habitat.—Carolina.

111. **CULEX PUNCTATUS,** Meigen (1818).

Wings unspotted; tarsi unbanded; thorax greyish brown, with four longitudinal lines; abdomen not banded, but ash grey, with two rows of triangular black spots.

Description from "F. R.," p. 281.—Proboscis brown; antennæ and palpi of the ♂ dark brown; thorax as above; legs brown with the coxæ yellowish at the base and beneath; wings brownish yellow, and the halteres yellowish white. The rows of spots on the abdomen are of triangular shape. Length, of the ♂, about 9 mm.; of the ♀, 7 mm.

Habitat.—Meigen described this species from Germany, and it has been noted by Stephens (but not by Walker) in England; and by Gimmerthal in Russia. Ficalbi has not met with it in Italy, and appears to doubt if this is distinct from *C. rusticus*, Rossi.

112. **CULEX TESTACEUS,** Van der Wulp.

Wings unspotted; tarsi unbanded (?); thorax with indistinct darker lines; abdomen yellowish-brown with darker lateral lines.

Description from "Tijdschr. voor Ent.," 1869, p. 128.—Head dark brown; vertex and occiput with dense brown hairs; antennæ light brown with black rings; the verticils light brown with light yellow lustre; proboscis longer than the head and thorax, light brown in the middle, darker at base and tip. Palpi light brown, the apices of the joints darker, the second longest; about a third longer than the first; the two last joints each half the length of the second joint. From just before the apex of the second joint to a little before the extremity of the palpus, on the under side, is a fringe of long, straight, dark brown hairs with brownish yellow reflections; on the opposite side, on the apex, a thinner stiff fringe; thorax dark yellow, brown above, its scales tipped golden-yellow, the ground colour showing through as separate longitudinal stripes. Scutellum agrees in colour and tomentum with the thorax; pleuræ yellowish brown behind; a yellowish white patch on the hind coxæ; abdomen flattened, yellowish-brown with a blackish lateral stripe on either side, especially dusky on the last segments, and there also forms a terminal border; the last segment entirely blackish brown. The claspers shorter than the last segment, yellowish-brown; the tomentum of the abdomen yellowish and moderately long and thick; legs and poisers very clear brownish yellow. Wings with a yellowish tint; the veins and their scales light brown; the upper basal cell longer than the lower.

Habitat.—North America.

113. **CULEX THORACICUS,** R. Desvoidy (1827).

Wings unspotted; tarsi unbanded; thorax reddish-yellow with two brownish streaks; abdomen unadorned, dorsally yellow; legs yellow. Very like *C. lutescens*, Fabr.

Description from "F. R.," p. 278.—Proboscis yellow with the apex black; antennæ brown; thorax reddish brick-yellow with two brownish streaks; legs yellow; wings yellowish; abdomen yellow; length about 8 mm.

Habitat.—Desvoidy described this species from Paris, but it has not been noted by anyone else.

114. **CULEX ACER,** Walker.

Wings unspotted; tarsi unbanded; thorax pale dull yellow with three pale brown stripes; abdomen unbanded, pale yellow; legs pale yellow, shaded with a darker tint at intervals.

Description from Walker, "List," p. 7.—Body dull pale yellow; proboscis dull yellow; thorax with three pale brown stripes; legs pale yellow, shaded with a darker colour at intervals. Wings colourless; veins dull yellow. Length of the body 2 lines; of the wings 4 lines.

The single type is in bad condition. The wing has the anterior fork-cell much longer and narrower than the posterior, with a shorter stem. The posterior transverse vein is short and placed more than twice its length internal to the middle transverse.

Habitat.—New Zealand.

115. **CULEX BICOLOR,** Meigen (1818).

Culex marginalis, Stephens, 1825.

Wings unspotted; tarsi unbanded; thorax dorsally greyish chestnut, with traces of darker longitudinal streaks; abdomen dorsally uniform pale yellow. Said to be less yellow than *C. lutescens*.

Description from "F. R.," p. 277.—Proboscis brown; palpi and antennæ of the ♂ yellowish brown. Thorax

with the dorsum greyish black (?), with traces of darker longitudinal streaks; pleuræ speckled yellowish. Coxæ yellowish, especially at the base and beneath; tibiæ darker yellow, and the tarsi brown. Wings brownish yellow, and the halteres yellowish. Abdomen with the dorsum pale dirty yellow. Length 7-8 mm.

Habitat. — Meigen describes this species from Austria, but Schiner states that he has not met with it; Stephens and Walker note it from England, and Gimmerthal from Russia. Perhaps, as suggested by Walker, it is identical with *C. lutescens*.

116. **CULEX MACLEAYI,** Skuse.

Wings unspotted; tarsi uniformly violet-black; thorax deep brown, densely golden-scaled, traversed by two longitudinal parallel bare (darker) lines; abdomen umber-brown with whitish bands into the formation of which two contiguous segments enter.

Description from "S. A. C.," p. 1745. ♀—Length of antennæ, 2·39 mm.; expanse of wings, 4·31 × 1·27 mm.; size of body, 4·81 × 1·01 mm. Antennæ fuliginous, about the length of the proboscis; scapus testaceous, except apex of second joint. Head deep brown, densely golden-scaled interspersed with a few brown hairs; proboscis violet-brown, lighter in the middle, six times the length of the palpi; palpi violet-brown; ground of thorax deep brown, densely golden-scaled, with scattered brown hairs, traversed by two indistinct, parallel, longitudinal bare lines; pleuræ lighter brown with a few small white-scaled patches and golden hairs; scutellum and metanotum red-brown, the former golden-scaled with long brown hairs; halteres ochreous. Abdomen twice the length of the thorax, deep umber brown, with slight violet reflections, each segment narrowly bordered with whitish scales in front, densely fringed behind and at the sides with long pale golden hairs; venter densely whitish-scaled; lamellæ of ovipositor light brown, densely pubescent. Coxæ ochreous or testaceous

with white scales and golden hairs; remaining leg joints violet-brown scaled and, except the tarsi, whitish beneath; in the hind legs the tibiæ slightly pale tipped and about equal to the metatarsi. Wings longer than the abdomen, hyaline, the veins densely clothed with long fine brown scales. Auxiliary vein joining the costa opposite the hinder branch of the fifth longitudinal; middle shorter than the posterior transverse vein, placed a little more than the length of the latter in front of it; first submarginal scarcely narrower, but considerably longer than the second posterior cell, its base lying a little before that of the latter and opposite the tip of the auxiliary vein; anterior branch of the fifth originating opposite half-way between origin of second and tip of sixth longitudinal vein, reaching the hinder border opposite the middle of the second posterior cell.

Habitat. — King George's Sound, Western Australia (Masters).

117. **CULEX CALCITRANS,** R. Desvoidy (1827).

C. flavirostris, Meigen, 1830.

Wings unspotted; tarsi uniformly brownish; thorax reddish with three brown stripes; abdomen banded yellow and black; ill-defined.

The descriptions of the above correspond so closely, that there can be, I think, no doubt of their being synonymous, and in the absence of Meigen's type, which is not among those in the Jardin des Plantes, there appears to be no advantage in retaining his more recently described species. It is also very near *C. acer,* Walker.

Description from "F. R.," p. 298. — Proboscis pale yellowish; antennæ of the ♀ brown; thorax dorsally reddish with three brown stripes, and with the pleuræ cinereous. Legs yellowish with the tarsi brownish; abdomen pale yellowish on the dorsum, but the incisuræ of the segments are streaked with blackish. Length 3 lines.

Habitat.—Paris and Germany.

118. **CULEX AGILIS,** Bigot.

Wings unspotted; tarsi without bands or spots; thorax fuscous with four indistinct black lines; abdomen with the middle of each segment marked by a small diffuse spot of pale brownish; the femora entirely pale yellow.

Description from Bigot, "Bull. Soc. Ent. France" (6), IX., p. 122.—Like *C. pipiens* and *C. ciliaris*, but appears to me to differ in the very pale tinge of the abdomen, with the middle of each segment marked by a small diffuse spot of pale brownish; legs very pale yellow, with only the tarsi and the extremities of the tibiæ brownish. Wings clear with brownish veins; thorax very deep reddish-brown above with two or four indistinct blackish lines. Length 6-7 mm.

Habitat.—Algeria.

119. **CULEX SALINUS,** Ficalbi (1896).

Wings unspotted; tarsi uniformly dark brown; thorax dark umber-brown; pleuræ with spots of whitish scales. Abdomen black, with hazel specks for the hinder three-fourths, nearly white for the anterior one-fourth, with no lateral spots on the dorsal aspect.

Description from "F.R.," p. 29. ♀—Head; nape of a burnt-umber tint, rather darker in the middle, the margins of the eyes appearing somewhat lighter owing to the presence of a golden tomentum; eyes dark metallic-green. Antennæ blackish-brown, with the basal joint lighter, with dull scales, palpi black, with some dull specks, especially sometimes at the tip; proboscis black, with usually some dull or yellowish speckles. Thorax; dorsum generally rather dark umber-brown; pleuræ with spots of nearly white scales; halteres yellowish-white, with the apex brown. Wings generally rather fuliginous, becoming somewhat yellowish when dried; veins densely clothed with black scales, with which are intermixed some of a light brown tint; fourchettes with their stems of nearly equal length;

in both, but especially in the anterior, the branches are a little longer than the stems. Legs, hips speckled. Femora yellowish-white beneath, except the distal fourth, which is brownish, owing to being speckled with black; above they are whitish at the very root, but elsewhere dark brown, from being closely black-speckled on a light brown ground, growing darker from base to tip; knees formed by a narrow ring of whitish, preceded by an intensification of the dark coloration above. Tibiæ generally brown, owing to a mixture of black and drab scales, the dark predominating above and the light below, sometimes there is a barely visible whitish border between the tibia and tarsus; tarsi of the same coloration as the tibiæ, but rather darker. Abdomen; dorsum black, much speckled, with a hazel tint on the posterior three fourths of the segments, and nearly white on the anterior fourth. Venter pale yellowish, with a black spot on either side of the posterior part of the third-seventh segments. In the dry state they often cannot be made out, owing to the contraction of the parts. Besides the above, these segments have an unpaired spot in the middle; hence the part of the segment in front of the lateral black spots looks much like a triangular white spot. Length 7-8 mm.; sometimes even 11 mm.

♂.—Nape and eyes as in the ♀. Antennæ dark brown. Palpi sparsely villous, just longer than the proboscis, generally dark brown throughout, but sometimes the long joint of its stem may show some white specks, and the hairs may have a yellowish reflection beneath. Proboscis as in the ♀. Thorax and its appendages as in the ♀. Abdomen rather densely fringed with yellowish white hairs; dorsum generally as in ♀, but the black parts of the segments are less speckled; venter as in the ♀, but the black marks, both lateral and median, are better marked, so that sometimes the lateral ones join to form a black hinder border to the segments. Length (including the proboscis) 6-7 mm.; sometimes even 10 mm.

Habitat.—Cagliari, diurnal. The larva lives in salt marshes, although capable also of existing in fresh water.

120. **CULEX PHYTOPHAGUS,** Ficalbi (1890).

Wings unspotted; tarsi uniformly nearly black; thorax yellowish-brown, the pleuræ paler, but with whitish-scaled spots; abdominal segments dusky, with straw-coloured basal bands; knees with a white point.

Description from "F. R.," p. 286.—Proboscis nearly black on the dorsum and on the anterior portion of the ventral side, and rather lighter tinted elsewhere; the palpi of the ♂ surpass the proboscis by the length of all the last and the end or the penultimate joint, and are nearly black, and very hairy, but show beneath two or three whitish points opposite the articulations between the joints; these spots are wanting in the ♀. Antennæ nearly black in both sexes; eyes metallic green, bordered with light tomentum; nape with "avana" yellowish brown tomentum. Thorax of the same tint as the nape, but darker, with golden hairs; pleuræ rather paler, with whitish scaled spots. Wings rather fuliginous, with the branches of the fourchettes longer than their respective stems, the anterior stem being a little shorter than the posterior; halteres dusky yellow. Legs with the coxæ yellowish, with specks formed by dusky and whitish scales; the femora light yellow beneath, and nearly black above, with a whitish knee-spot formed by a minute terminal ring; tibiæ nearly black, with a minute distal whitish ring; tarsi uniformly nearly black. Abdomen densely furnished with bristly golden hairs; deep chocolate-colour dorsally, with yellowish basal bands; ventrally the segments are yellowish, with almost black spots in the middle, and at the sides. Length of the ♂ 5-7 mm.; of the ♀ 8 mm.

Habitat.—One of the commonest species in Italy, but had previously been confused with *C. pipiens*, from which, however, it is quite distinct. It does not suck blood, being purely phytophagous, and only enters houses by accident, or to hybernate.

121. **CULEX GUTTATUS,** Curtis (1829 and 1834).

Wings unspotted; tarsi unbanded; thorax reddish-black, the pleuræ grey, with about six white spots; abdominal segments dusky, with basal white bands, and triangular white lateral spots; knees white.

Description from "F. R., p. 286. ♀ —Proboscis brown (?); antennæ pale; margins of the eyes white; thorax dorsally reddish (?) black, the pleuræ grey with about six white spots. Wings brown; halteres dirty yellow. Legs with the hips white, the coxæ white beneath and brown above and towards the distal end, but all marked with white at the point (knees white). Abdomen dorsally ochraceous brown, each segment with a basal white band, besides which there are twelve triangular, lateral white spots.

Habitat.—Curtis described this species from England; Walker considered it synonymous with *C. nemorosus,* and afterwards with *C. calopus*; Schiner, with *C. nemorosus.* It has not been noted elsewhere. Meigen thinks it a variety of *C. ornatus.*

122. **CULEX TRISERIATUS,** Say (1822).

Wings unspotted; tarsi unbanded (?); thorax rather dark blue, with white hairs on either side, pleuræ with two large white hairy spots; abdomen brown (?), with a triangular white spot on either side of the base of each segment and a median row on the venter.

Description from Thomas Say, "Journ. Acad. Nat. Sci." Philadelphia, III., p. 12. —Anterior margin of the wings fuscous; abdomen spotted white on the back, on either side 2½ lines, ♀.

Body brown; thorax rather dark blue, with white hairs on either side; pleuræ with two white, hairy spots; abdomen with a triangular white spot on either side of the base of each segment; these spots correspond with bands across the belly, which are twice interrupted, so

that each band shows as three spots, on each segment, the middle spots forming a sort of stripe along the belly. Legs yellowish, with brownish hairs; femora naked, blackish above, at the apex.

Habitat.—From Pennsylvania.

123. **CULEX AUSTRALIS,** Erichson (1842).

C. pervigilans, Bergroth (1889); *C. iracundus,* Walker, "List," p. 6 (1848); *C. crucians,* Walker (1856) (?). Wings unspotted; tarsi without bands or spots; thorax unadorned, golden-scaled. Abdomen with basal white bands; knees and apices of the tibiæ white.

Description from Bergroth, "Wiener Entomolog. Zeitung," 1889, p. 295, and from Erichson, "Archiv. für Naturg.," VIII., p. 276. ♀—Head with golden scales above. Antennæ and palpi dusky black; proboscis dusky black with a broad livid area in the middle below. Thorax densely yellow-scaled above with a few fuscous hairs, which are longer on the scutellum and behind; the pleuræ dusky reddish. Wings slightly longer than the abdomen, greyish hyaline, iridescent, the veins thickly clothed with long black scales. Auxiliary vein extending a little beyond the base of the first sub-marginal cell, its apex nearly opposite the end of the posterior branch of the fifth longitudinal; the base of the anterior branch of the fifth longitudinal nearer the base of the second longitudinal than to the apex of the sixth longitudinal vein, which last is opposite the middle of the second posterior cell; first basal cell longer than the second; first sub-marginal cell much longer than the second posterior and very distinctly nearer the base of the wing; halteres livid white, with the base of its knob fuscous. Legs dusky black; thighs livid beneath, with narrow white bands on the knees and at the apex of the tibiæ; hinder tibiæ equal in length to the first tarsal joint. Abdomen twice as long as the thorax, dark fuscous, the segments ornamented with basal white rings. Length 6 mm.

Testaceous, the thorax dorsally fuscous, the abdomen black banded, the femora and tibiæ pale at the extreme apex; proboscis somewhat elongate, a little longer than the male palpi. Head fusco-testaceous; thorax fuscous on the back, testaceous on the pleuræ and below. Abdomen covered with grey pilosity, segments pale at the base and black at the apex. Legs fusco-testaceous, with the femora and tibiæ white at the extreme apex. Wings hyaline, veins testaceous, with the anterior ones fuscous-villose. Length of the body 3½ lines; of the proboscis 2 lines.

There can be, I think, no doubt, that the above two descriptions refer to a single species. The wings of Walker's *C. crucians* also correspond with Bergroth's description.

Habitat.—New Zealand and Tasmania.

124. **CULEX CRUCIANS,** Walker.

Wings unspotted; tarsi unbanded (?); thorax unadorned, fuscous (?); abdominal segments dusky, with reddish-white basal bands. Probably a synonym of *C. Australis*, Erichson.

Description from Walker, "Insecta Saundersiana," Vol. I., Dipt., 1856, p. 432. ♀—Fuscous; proboscis fuscous to the apex. Antennæ black, basally fulvous: pectus fulvous; abdomen with testaceous white bands; coxæ and femora testaceous; wings greyish, with the veins slightly cinereous-ciliate, testaceous at the base; halteres testaceous. ♂—Brown; proboscis slender, straight, tawny, brown at the tip. Antennæ black, shorter than the proboscis, tawny at the base; pectus tawny. Abdomen darker than the thorax, with a whitish testaceous band in front of each segment. Legs brown; coxæ and femora testaceous. Wings greyish; veins brown, slightly ciliated, testaceous at the base; halteres testaceous. Length of the body 3½ lines; of the wings 6 lines.

In Walker's type the wings are proportionally long, extending well beyond the abdomen. The wings have the bases of the fork-cells opposite, both very large, with rather

short, equal stems. The supernumerary and middle transverse veins are in one straight line; and the posterior transverse, which is longer, is placed more than its length internal to them. None of the tarsal joints remain.

Habitat.—Tasmania."

125. **CULEX NIGRIPES,** Zetterstedt (1840).

Wings unspotted; tarsi unbanded, blackish (?); thorax dorsally blackish with some ferruginous hairs. Abdominal segments black with basal white bands in the ♀; uniformly black in the ♂; knees unspotted.

Description from "F. R.," p. 292.—Proboscis black, and the palpi and antennæ nearly so; thorax with the dorsum entirely blackish, with some ferruginous hairs, especially in the ♀, and the pleuræ (in the ♀ alone) speckled cinereous. Wings cinereous; halteres brown. Legs blackish; the dorsum of the abdomen, totally black in the ♂, (?) has seven basal white bands to the segments of the ♀. Length 6-7 mm.

Habitat.—Lapland and Greenland.

126. **CULEX CONFIRMATUS** (Arribálzaga).

Ochlerotatus confirmatus, Arribál. "L. A.," p. 46.—Wings unspotted; tarsi without obvious bands; thorax grey with some golden scales; abdominal segments dark violet-black, with silky white basal bands; terminal joint of female palps very minute.

Description from "L. A.," p. 46.—Antennæ dark fuscous with long fuscous verticils, the basal joint and base of the next testaceous. Head dark pitch brown and naked in front, behind silky grey with a few silvery scales and fuscous hairs, beneath pitch-brown; eyes green during life, greyish olive after death; proboscis dusky red, pitchy towards the apex; palpi almost black. Thorax dorsally in front with closely packed silvery grey and a few silky golden scales; behind and on the entire lateral margins

with dark fawn scales; in front it appears destitute of hairs, but behind long dusky hairs are numerous; pleuræ pitch-brown in front, but with an almost silvery lustre in the middle and behind; scutellum dark fawn with dusky hairs. Wings hyaline with dense dusky scales; halteres pale with the knob slightly testaceous. Legs pale yellowish; the fore tarsi somewhat dusky; middle and hind knees, the apex of the tibiæ, and the tarsi pale fuscous. Abdomen dusky black above, tending to violet in certain lights, with silky white cross-bands, beneath silky grey. Length 5 mm. ♀.

Though unavoidably separated from it by the tabulation, the natural neighbour of this species is *C. albifasciatus*, Macquart, with which it is associated by Arribálzaga in his new genus *Ochlerotatus*, in which the last joint of the ♀ palpi are very small and generally hidden among the scales of the fourth joint, while in the male the two last joints are almost equal and gradually thickened towards the extremity, and but little longer than the proboscis. In the wings, the first sub-marginal cell is of equal length, but narrower than the second posterior. Legs very long and slender; the claws armed near their middle beneath with a tooth in both sexes, but, in the male, with the anterior claws larger and with the external one twice as long and thick as the internal.

Habitat.—Buenos Ayres, Argentina.

127. **CULEX INORNATUS,** Williston.

Wings unspotted; tarsi brownish with white tomentum (?) unbanded. Thorax unadorned reddish-brown. Abdomen black with basal white portions to the second and third segments.

Description from "North American Fauna," Washington Government Press, 1893.—Female.—Palpi yellowish-brown; proboscis yellowish, black at the tip. Antennæ black, the basal joints yellowish; occiput black, clothed mostly with whitish pubesence; thorax red, the dorsum reddish-brown, thinly clothed with light yellow and white

tomentum, and blackish bristly hairs; pleuræ with white tomentum. Abdomen black, somewhat yellowish in the ground colour on the second and third segments, covered with white, scale-like tomentum on the front and sides of the segments, on the posterior part of the segments with blackish tomentum. Legs brownish; on the inner side thickly, on the outer thinly, covered with white tomentum. Wings nearly hyaline, the tomentum of the veins blackish. Length 5-6 mm. Belongs to genus *Culex* in the restricted sense of Lynch. One specimen, Argus Mountains, April 1891.

128. **CULEX STITICUS**, Meigen (1838).

Wings unspotted; tarsi unbanded; thorax unadorned black with rufous tomentum; abdomen nearly black, adorned with white basal bands, narrow in the middle and broad externally. Differs from *C. pipiens* in the bands on the abdomen being pure white instead of fawn, and in the stem of the anterior fork-cell being of equal length to that of the posterior instead of being markedly shorter.

There are two ♀ specimens, labelled both as types, in the Jardin des Plantes, but only one corresponds to Meigen's description. There can be no doubt that the other is a perfectly normal specimen of *C. pipiens;* and, in spite of the above-mentioned differences, I doubt if the other is more than a light coloured variety of that species, with a somewhat abnormal wing. Both bear the same number but that that corresponds to Meigen's description has a small square label.

Taking this as the type, I find the head with the vertex reddish; the antennæ rather pale brown with hoary tomentum; the proboscis uniformly rather light rufous brown; the palpi reddish-brown unbanded; eyes black. Thorax with much rufous tomentum, black where denuded, apparently unadorned. The abdomen is dorsally warm dark brown, and would, I think, be described by most people as with the segments basally white banded, as

though they expand much laterally so as to form the so-called spots, they are easily traceable right across the segments. The coxæ are pale yellowish and the legs rather pale brown throughout, there being no trace of any banding of the tarsi. The wings are hyaline, the veins and costa brown-scaled, and the internal marginal fringe whitish, nearly snowy at the axilla; there are no spur-like extensions inwards of the second or fourth longitudinal veins; the first sub-marginal cell is longer and narrower than the second posterior, but their stems are of equal length; the middle and supernumerary transverse veins form a straight line, the posterior transverse being half its length behind them. The other specimen is, I think undoubtedly, merely a specimen of *C. pipiens* that has somehow got misplaced. Length 4 mm.

In the British Museum are three specimens so identified from England, all much rubbed. The wings correspond with the Paris specimens and the knees are white. It appears a more slender and delicate species than *C. pipiens*.

Habitat.—Bavaria.

129. **CULEX IMPIGER**, Walker.

C. implacabilis, Walker, "List," p. 7.

Exactly like *C. pipiens*, but with the abdominal bands whiter but probably identical with it; in *C. implacabilis* these, however, are yellow. Length of the body 2 lines; of the wings 4 lines.

The type specimens are two of *C. impiger* and one of *C. implacabilis*. As far as I can see there is little or nothing to distinguish them either from each other or from *C. pipiens*, *L.*

Habitat.—St. Martin's Falls, Albany River, Hudson's Bay.

130. **CULEX NIGRITULUS,** Zetterstedt (1850).

Wings unspotted; tarsi brownish, unbanded; thorax brownish ferruginous, unadorned; abdominal segments dark brown with light grey basal bands.

Description from "F. R.," p. 291. ♀—Proboscis, palpi and antennæ black; thorax dorsally brownish ferruginous. Wings brownish; legs with the coxæ dirty yellow at the base, clearer in the middle and the rest brownish. The abdomen is generally dark brown, but the incisuræ are bordered rather than banded with a lighter tint of cinereous (inserted as anterior because stated to be like *C. nemorosus*.) Length about 2 lines.

Like *C. nemorosus* but smaller and with less marked light abdominal bands.

Habitat.—Scandinavia.

131. **CULEX PIPIENS,** L. (1758).

C. vulgaris, et *C. alpinus*, L. olim.; *C. consobrinus*, R. Desvoidy (?) Essai, p. 408; *C. ciliaris*, L. (?); *C. stiticus*, Meigen (?); *C. provocans*, Walker (?); *C. impiger*, Walker (?); *C. implacabilis*, Walker (?).

Wings unspotted; tarsi unbanded, yellowish brown; thorax pale testaceous, unadorned, black when denuded; abdomen reddish-brown, the segments with yellowish basal bands, narrow in the middle and expanding laterally; knees unspotted.

Description from "F. R.," p. 287.—Proboscis chocolate brown, darker in the apical quarter; palpi of the ♂ longer than the proboscis, very hairy and of a rather light brown; of the ♀ nearly black, with sometimes some whitish hairs at the apex; antennæ with the first joint and the base of the second pale yellow, the first with scales of the same colour; the rest of the organ brownish-black, paler in the

♂. Eyes metallic green with margins of pale yellow tomentum; nape light coloured, generally pale yellow with rather numerous hairs; thorax with the dorsum villous, generally pale testaceous, from a darker reddish-brown ground colour shown through abundant golden hairs; pleuræ paler, speckled with flaxen scales. Wings rather dark flaxen; anterior fourchette with its branches much longer than its stem, which is exceptionally short; the branches of the posterior fourchette are also longer than its stem, but the latter is still distinctly longer than that of the anterior. Legs with the coxæ light brownish-yellow; femora yellowish white beneath, but with the upper margin somewhat brownish, and with a dark brown border at the distal extremity followed by a whitish line visible only with a lens; tibiæ brownish, and the tarsi uniformly dark brown. Abdomen moderately furnished with yellowish hairs; dorsally the hinder three-fourths, about, are chocolate brown, and the remaining anterior part tawny yellow, the light part expanding somewhat laterally so as to form a sort of lateral spot; on the sixth and seventh segments the light portion predominates, so that the dark portion is reduced to a triangular spot; ventrally the abdomen is uniformly pale tawny yellow. Total length of the ♀, 7½-8 mm.; the ♂ a little smaller in all ways.

It appears doubtful if the common European species is really the original species described from Lapland by Linnæus. Possibly our common gnat should properly be denominated *C. hæmatophagus*, but whatever the name, it is the commonest gnat throughout the greater part of Europe; and it is also recorded in North America in Osten-Sacken's list. A dark variety which differs only in the palpi and tarsi being brown instead of yellowish is given under the name of *C. consobrinus* by Desvoidy in his "Essai." As a matter of fact, the tarsi generally are brown and not yellow.

There are a large number of species which either closely resemble or are synonymous with this species.

Habitat.—Common all over Europe from Russia to Malta. It is undoubtedly the most common European

gnat, and is usually nocturnal in habits, and it is only the ♀ that bites.

132. **CULEX CILIARIS,** L. (1767).

Wings unspotted; tarsi unbanded; thorax unadorned, reddish ferruginous; abdominal segments reddish-brown with flaxen basal bands, less contrasted than in *C. pipiens*. Smaller than that species.

Description from "F. R.," p. 289.—Proboscis brown above and below; palpi of the ♂ notably longer than the proboscis, light testaceous brown; those of the ♀ rather browner. Antennæ of the ♂ with the plume reddish yellow; of the ♀ brown. Nape very light reddish; thorax dorsally reddish ferruginous. Wings yellowish ferruginous. Legs almost as in *C. pipiens;* abdomen with the dorsum of the segments generally ornamented with a band of flaxen whitish on their anterior third, the remainder being of a more or less brownish testaceous; but, as Schiner remarks, many individuals have the abdomen entirely yellowish ferruginous with hardly a trace of banding. Length of ♀ 6-7 mm.

Ficalbi, who is familiar with it only through dry specimens (not Italian), enquires if this may not be merely a dwarf variety of *C. pipiens*.

Habitat.—Described as rare in Sweden by Linnæus, and has since been noted, either correctly or under its synonym, from Germany, Austria, Russia and England.

133. **CULEX DETRITUS,** Haliday (1833).

Wings unspotted; tarsi unbanded (?); thorax dark brown (?); abdomen with pale bands.

If in any way distinct, is probably only a variety of *C. pipiens, L.*

Description from Haliday, "Entomological Magazine," Vol. I., p. 151.—Blackish-brown, with the abdomen palely banded, with three fuscous spots on the belly, and the bases

of the femora pale yellow. Of the size of *C. pipiens*, palpi of the male rather thick, as long as the proboscis. Wings thickly armed with dusky black scales; disc of thorax nearly naked.

The type ♀ in the British Museum is a good deal larger than the average *C. pipiens*, and the stems of the fork-cells appear longer, but I can see nothing else on casual examination to distinguish them.

Habitat. — Holywood, County Down, in multitudes during the day in hedges on the sea coast, and in the evening in columns at the tops of the trees, looking like smoke at the distance of a furlong.

134. **CULEX PROVOCANS**, Walker.

Exactly like *C. pipiens*, differs only in the redder tint, and in the hairs of the body, being white instead of golden in the ♂. Length 2½ lines; of the wings 5 lines.

Although there is little in Walker's description to distinguish this species from *C. pipiens*, I am inclined from a casual inspection of the type to think they may be distinct. In Walker's species the contrast between the darker and lighter abdominal bands is much more striking, the latter being pure white (as noted by Walker). The male appears to have a longer body and the stems of the fork-cells of the wings are longer than in *C. pipiens*, and the posterior fork-cell appears to be much wider and with more divergent branches than in that species.

Habitat.—North America, Nova Scotia.

135. **CULEX PERTERRENS**, Walker.

Wings unspotted; tarsi unbanded (?), brown; thorax unadorned, testaceous; abdomen purplish, with a testaceous band on the fore border of each segment.

Description from Walker, "Insect. Saunders.," p. 431.—Brown, rather stout; proboscis testaceous, long, brown towards the tip. Antennæ brown, very little shorter than

the proboscis; pectus testaceous; abdomen purplish, with a testaceous band on the fore border of each segment; under side testaceous; legs stout pubescent; femora and tibiæ brown towards their tips; tarsi brown. Wings grey; veins blackish, slightly ciliated; halteres testaceous. Length of the body 4 lines; of the wings 6 lines.

Habitat.—South America.

136. **CULEX NIGRITHORAX,** Macquart.

Wings unspotted; tarsi unbanded, light brown (?); thorax rather dull black, unadorned; abdominal segments fuscous with yellowish-white basal bands, the last one black.

Description from Macquart, "Dipt. Exot.," 2nd. Suppl., 1847, p. 9. ♂.—Thorax black; abdomen fuscous, with whitish incisuræ; legs rufescent; proboscis black; palpi and antennæ brownish; thorax and pleuræ rather dull black; abdomen with the anterior border of the segments yellowish-white; last segment and copulatory armature black; venter with whitish hairs; legs rather bright tawny; extremity of femora brownish; posterior tarsi brownish. Wings a little yellowish, with reddish veins; cells normal. Length 3½ lines.

Habitat.—Tasmania.

137. **CULEX HORTENSIS,** Ficalbi, 1889.

Wings unspotted; tarsi uniformly blue-black; thorax mouse-coloured tending to yellowish, unadorned; abdominal segments blue-black with white distal bands; knees with distinct white spots.

Description from "F. R.," p. 292.—Proboscis blue-black above, rather lighter at the apex; palpi of the ♂ which are pointed and longer than the proboscis, as well as of the ♀, blue-black, with a middle white ring, especially distinct in the ♀. Antennæ grey-blue almost black, in both sexes, with a ring of light blue scales on the basal joint; eyes dark metallic green bordered with light tomentum; nape with

grey tomentum and numerous light yellow hairs; dorsum of the thorax mouse-coloured tending to yellowish; pleuræ and the continuous parts of the coxæ bluish-white. Wings blackish, the fourchettes with their branches much longer than their stems, the anterior of the latter being a trifle the shorter; halteres light-coloured. Legs with the femora yellowish-white at the base and beneath, except a small portion near the end, blue-black above, save at the base, and a terminal white ring, which forms a distinct knee-spot; tibiæ blue-black, with an apical white ring; tarsi entirely blue-black. Abdomen very hairy, especially laterally, the hairs being fulvous white; dorsally it is banded black and white, the latter being the narrower and placed at the hinder part of each segment; ventrally the segments are white with a black spot on either side. Length of the ♂ 5-6 mm.; of the ♀ 8 mm.

Habitat.—Ficalbi has found this species in different parts of Italy, and believes that it neither attacks man nor enters habitations but subsists on the juices of plants.

138. **CULEX INCIDENS,** Thomson.

Wings unspotted; tarsi uniformly dusky (?); thorax unadorned, fuscous marbled with fulvous scales; abdominal segments black, fringed with white scales on their hinder margins; femora whitish with black tips.

Description from Thomson, "Eugen. Resa. Dipt.," p. 443.—Fuscous and opaque, the abdomen black, with the segments bordered black; the legs blackish, with the coxæ and femora whitish, the latter with the apex and a line above black; wings with the transverse veins as usual, and falling into the brachial, somewhat hyaline, with a band in the middle pellucid. Length ♀, 5 mm.

Of the same size as *C. camptorynchus*, but with the proboscis straight and the abdomen white-ringed; the ordinary transverse and brachial transverse veins in the same vertical line; fuscous and opaque. The head ovate-orbicular, narrower than the thorax, sparsely clothed with

sub-erect, fuscous hairs, with the eyes large and somewhat reniform, nearly joining on the front, the vertex convex and brown; the palpi fuscous; the proboscis of the length of the abdomen, straight, thin and filiform, fuscous. Antennæ fuscous, not reaching to the apex of the scutellum, the joints sparsely verticilled with erect hairs, the first joint large and nearly globose, longer than the second and third joints; thorax oblong, compressed, twice as deep as it is wide, the dorsum convex; the pronotum not distinguishable above; the mesonotum apically produced; with no dorsal lines; fuscous in colour and faintly marbled with scale-like fulvous hairs; the pleuræ more densely clothed with whitish scales; the scutellum short, with the transverse basal line distinctly marked, and the apex adorned with numerous porrect hairs; the post-scutellum sloping downwards, fuscous brown, nearly glabrous, opaque, with a short basal keel. Wings of the length of the abdomen, hyaline, with a distinct lobe, and the alula with long cilia; the inferior margin and veins furnished with long caducous, closely-packed brown hairs; nearly glabrous in front of the forks of the cubital and brachial veins, so as to form a sort of transverse band; the mediastinal vein reaching the costa in its third part, the post-costal running out to the apex; the cubital originating a little behind the middle of the wing, in front of the ordinary transverse vein, and with its fork densely scaled; the brachial fork a little shorter than the cubital, reaching the margin of the wing a little beneath the apex; the ordinary and brachial transverse veins originating at the same point; the humeral forking in the middle of the wing, the fork reaching to the inferior margin; the axillary vein quite obsolete; halteres dark testaceous. Abdomen nearly twice as long as the thorax, somewhat depressed and a little narrower, inserted high above the posterior coxæ with dense, long whitish hairs at either side of the base; the segments from 2 to 6 of equal length, with scanty black, opaque hairs, and the hinder margins clothed with closely packed, scale-like whitish hairs. Legs long and very thin, with the coxæ whitish and of equal length; the femora and tibiæ sparsely adorned with erect

hairs of equal length and not shorter than the abdomen, nearly filiform and not clubbed, dusky black; the latter whitish at the apex and inferior margin; the tarsi elongated with the first joint barely shorter than the tibiæ, the remaining joints sensibly diminishing in length, the fifth and fourth being nearly twice as short; unguiculi small, with scarcely any pulvilli.

Habitat.—California.

139. **CULEX DOMESTICUS**, Germar (1817).

Wings unspotted; tarsi brown, unbanded; thorax unadorned, pale yellow; abdominal segments black, with greyish-yellow apical bands; anal extremity yellowish.

Description from "F. R.," p. 293. ♀.—Proboscis and palpi brown; antennæ dark brown, with the basal joint yellow; eyes black; nape with reddish yellow tomentum intermixed with brilliant yellow hairs; thorax with the dorsum yellowish, lighter at the sides; wings yellowish. Legs brown, especially the tarsi, and, in a dried specimen examined by Ficalbi, there did not appear to be any white knee-spot. Ground colour of the abdomen black, with greyish-yellow bands on the hinder part of the segments; anal extremity yellowish. Length about 7½-8 mm.

Habitat.—Described by Germar from Dalmatia, and doubtfully noted in England by Stephens. Ficalbi knows it by a dried specimen left by Rondani who obtained it in Italy.

140. **CULEX MERIDIONALIS**, Leach (1825).

Wings unspotted; Tarsi greyish-brown, unbanded?; thorax reddish-brown, unadorned; abdominal segments reddish-brown, with lighter apical bands.

A purely nominal species.

Description from "F. R." p. 294.—Head and thorax reddish-brown; legs greyish-brown; abdomen dorsally reddish-brown with lighter bands on the dorsum of each segment behind. Length 5 mm.

Habitat.—Described by Leach as common in Nice, but has been met with by no one else, and the description is too incomplete to admit of any future find being identified with it.

141. **CULEX CRASSIPES,** Van der Wulp.

Wings unspotted; tarsi uniformly dark red-brown with paler reflections; thorax unadorned, clear reddish-brown. Abdominal segments ashy-brown, with distal reddish-yellow bands and lateral borders. Dark lateral spots on venter o four first segments. Legs exceptionally thick.

Description from "Dipt. der Midden Sumatra," p. 9.—Fulvous with the abdomen of the same tint but paler, th incisuræ pallid, the belly with fuscous lateral spots; th coxæ and the bases of the femora pale rufous. Lengtl 4 mm. ♀.

Thorax clear reddish-brown; the head more faded yellow with hairs of the same colour. Antennæ, proboscis and palpi greyish-brown; proboscis longer than the head and thorax together, slender at the root, but quickly growing thicker, sharp at the apex with a pale yellow point; palp as long as the head; eyes not united. Abdomen ashy brown, the hinder edge of the segments and the border or either side reddish-yellow, four dark brown lateral spots o the ventral aspect of the first four segments which shov through more or less on the dorsum. Legs thicker than i other species; coxæ and the basal half of the femora ligh reddish-yellow, the rest of the legs of an uniform dark brown tint with, in certain lights, on the tarsi alone, pale reflections; halteres reddish-yellow. Wings with a fain yellowish tint and brown veins; base of the lower fork-cel somewhat nearer the base of the wing than the upper fork cell; hinder vein thicker at the root than the middle vein.

The author finds no species near this described i Dipterological literature.

Habitat.—Sœrœlangœn.

142. **CULEX CYANEUS,** Fabr.

Wings unspotted; tarsi unbanded, black; thorax steel-blue (?), unadorned; abdomen steel-blue, with a white, silvery lateral line, the venter silvery; bases of femora silvery.

Description from Wiedeman, "Dipt. Exot.," p. 8.—Steel-blue, with the sides of the abdomen, belly, and the bases of the femora silvery. Length 3¼ lines (German).

Fabricius, "Syst. Antl." 35, 9.—*C. cyaneus.* Blue, with a white line on the sides of the abdomen. Of the size and figure of *C. pipiens.* Head blue with a black proboscis; thorax blue; abdomen flat; lateral lines white. Legs very long, black, with copper-coloured tibiæ.

Antennæ fuscous; head steel-blue; thorax, abdomen and legs steel-blue, the latter tending to a coppery tint. Wings limpid, their veins with dusky scales

Habitat.—South America.

143. **CULEX RUSTICUS,** Rossi (1790).

C. quadratimaculatus, Macqt. (1834).

Wings unspotted; tarsi unbanded; thorax brownish-grey; abdominal segments brownish, with black lateral spots.

It is obvious that the description of scaly black spots such as are found on the sides of the abdomen of both species, as triangular in the one case and quadrangular in the other, cannot be accepted as sufficient, as, apart from individual variations, the outline of such spots is never definite, and any two observers would, as likely as not, use different terms in describing absolutely the same specimen.

Description from "F. R.," p. 280.—Proboscis black; dorsum of the thorax brownish-grey. Legs brown with the femora paler, but black at the apex. Wings dusky; abdomen brownish, with a black spot on either side of each segment. Length 7½-8½ mm.

Habitat.—Rossi described his species from Tuscany, and Rondani also notes it from Italy while Desvoidy notes it

from Paris. Ficalbi has not met with it except in the case of a defective specimen in an old collection and, in view of the fact that the descriptions are contradictory in some points, appears to doubt if it is a good species.

The habitat of *C. quadratimaculatus*, Macqt., is given as France.

144 CULEX LUTESCENS Fabr. (1775).

Wings unspotted; tarsi unbanded; thorax unadorned, yellow; abdomen yellow; proboscis black at the tip.

Description from "F. R.," p. 277.—Meigen describes the predominating colour as yellow. Macquart, yellow with brown tarsi.—Proboscis black or brown towards the point. In the ♂ the palpi are also black or brown towards the end, and the antennæ have a brown ring on the stem. In the ♀ the antennæ and palpi are black or brown. On the dorsum of the thorax the yellow has a reddish tint. Wings limpid, of a yellowish shade, especially along the anterior border; veins pale; tarsi brown. Length 2½ lines (Meigen).

Habitat.—Fabricius describes this species from Hafnia, Scandinavia; Stephens and Walker from England; Gimmerthal from Russia; and Meigen and Schiner from Germany. Ficalbi has not met with it in Italy.

145. CULEX OCHRIPES, Macquart.

Wings unspotted; tarsi unbanded, yellow; thorax unadorned, brown; abdomen unbanded, uniformly brown; palpi, ♂, long, rather long; yellow, black at the tip.

Description from Macquart, "Dipt. Exot.," Suppl., IV., p. 11.—Fuscous; palpi of the ♂ somewhat elongated, yellow with the apex black; legs ochraceous. Length 3 lines (♀).

Proboscis three-quarters of a line in length, yellow except at the extremity where it is brown; palpi rather elongated, exceeding the proboscis by a third of its length yellow with the last joint black, somewhat dilated; face and rostrum a brownish drab; frons brownish; antennæ

missing; thorax and abdomen (when denuded) brown; legs of a ferruginous yellow. Wings greyish, reddish on the outer border.

Habitat.—South America

146. **CULEX FUSCULUS,** Zetterstedt (1850).

Wings unspotted; tarsi unbanded (yellowish-brown); thorax clothed with ferruginous tomentum, the pleuræ dark slate colour; abdomen dorsally black.

Description from "F. R.," p. 278.—Palpi of the ♂ rather longer than the proboscis and with the two last joints somewhat dilated; the antennæ with brownish plumes; dorsum of the thorax clothed with ferruginous tomentum; the pleuræ dark slate colour. Wings cinereous; legs with the femora and tibiæ yellowish, rather browner at the apices; knees marked by a white spot; tarsi yellowish-brown especially on the last joints; abdomen dorsally black. Length of the ♂ 2½, of the ♀ 2 lines (Zetterstedt). Some individuals have dirty white spots on the sides of the abdomen.

Habitat.—Zetterstedt described it from Scandinavia; and Siebke from Norway.

147. **CULEX SETULOSUS,** Doleschall.

Wings unspotted; tarsi pale, unbanded, densely ciliate; thorax with ash-grey tomentum; abdomen dorsally unbanded, light brown, but with darker stripes on the venter. Obviously very near *C. cilipes*, Fabr.

Description from "Natuurkundig Tidsch. voor Neder. Ind.," Deel XIV., p. 384.—Pale fuscous, hairy, thorax slightly narrowed in front, rotund, thickly clothed with ash-grey hairs; abdomen even paler, bristly; the legs of an uniform fuscous tint. The wings pellucid, hairy, with yellow veins. Length 2 lines (Dutch).

Habitat.—Middle Java, like *C. nero*, during the dry season, in dwelling houses, equally numerous, and not less troublesome.

One of the largest species. The head cordiform; the eyes glittering metallic green; the palpi and proboscis light brown, the former somewhat curved outwards with stiff hairs. The antennæ of the male moderately long, with long black feathery hairs; the thorax rounded oblong, high, densely clothed with short hairs, greyish-brown. The abdomen narrow, light brown, with indistinct black cross stripes, clothed with long hairs on the reverse side; the legs are coloured like the rest of the body, densely hairy. The wings colourless with brown veins and a finely haired hind border. The female differs only as to the antennæ and palpi, and is similarly coloured.

148. **CULEX MODESTUS,** Ficalbi (1889).

Wings unspotted; tarsi without white bands (black); thorax unadorned, dorsally blackish, yellowish behind; abdomen dorsally dark brown, unbanded, with sparse lateral yellow hairs and clear yellow beneath.

Description from "F. R.," p. 279. ♀—Proboscis and palpi black; antennæ with the basal joint yellowish speckled with black, and the rest of the organ entirely black; eyes dark metallic green with the margins of a lighter tint than the nape, which is dark brown; thorax dorsally dark brown especially in front, the colour tending quite behind to yellowish; pleuræ yellowish; scutellum glabrous, dusky yellow; halteres yellowish speckled with brown. Wings blackish-brown; fourchettes with their branches longer than their respective stems; the stem of the anterior shorter than that of the posterior. Legs with the coxæ clear yellowish with some blackish scales, the latter more abundant on the anterior aspect of the coxæ of the front legs; femora clear yellow beneath throughout, with the exception of a very faint black spot near the distal extremity; above they are black, but a very delicate whitish border, without any co-operation of the tibia, gives the appearance of a white knee, especially well-marked in the hind legs; the tibiæ and the tarsal joints are black. The abdomen is sparsely furnished laterally with

very short fine yellowish hairs, and its dorsal surface is uniformly dark brown, saving a scanty yellowish speckling; at the sides there are some clear yellow spots, and the venter is uniformly yellowish, with the exception of a small black spot at the base of the last segment. Total length (including the proboscis) 6-7 mm. ♂ unknown.

Ficalbi appears doubtful if this species should not be considered as identical with *C. fusculus*, Zetterstedt; and the differences, if any, seem too small to warrant the establishment of the separate species.

Habitat.—The marshes near Ravenna in summer. The ♀ bites furiously at night and is very noisy.

149. **CULEX OBLITUS,** (Arribálzaga).

Janthinosoma oblita., Arribál.

Wings unspotted; tarsi without obvious bands; thorax unadorned, dark grey; abdomen undescribed, but presumably unbanded.

Description from "L. A.," p. 54. ♂.—Hoary or dark cinereous, with scanty frosty cinereous scales. The first twelve joints of the antennæ with the bases pale and slender, and the apices thickened and piceous, all with not very dense pale fuscous plumes; the last two joints fuscous; eyes black; proboscis pale testaceous, with the base and apex dusky; palpi longer than the proboscis; the two basal joints short and piceous, the remaining two pale yellow, with scanty villosity; the last wanting. Legs pale yellow, with the joints indistinctly testaceous; tibiæ longer than the first tarsal joint; the anterior and middle tarsal claws are wanting, but the hinder are long, the external over twice as long as the inner one, with a very long additional tooth beneath; wings hyaline, slightly yellow, the veins clothed sparsely with long slender fuscous scales; first sub-marginal cell twice as long as its stem, the second posterior of the same length as its stem. Length 4·50 mm.

This species is associated with *C. discrucians*, by Arribálzaga, in his new genus *Janthinosoma*.

Habitat.—Navarro, in Argentina.

150. CULEX OBTURBANS, Walker.

Wings unspotted; tarsi unbanded; thorax with brown tomentum, unadorned; abdomen cupreous greenish, with a white dot near the tip.

Description from "Journ. Proc. Linn. Soc. Lond.," IV. (1860), p. 91.—Female, blackish; proboscis pale; its sheaths dark, longer than the thorax; disc of the thorax with brown tomentum; abdomen with cupreous tomentum, and with a slight greenish tinge towards the tip; a white sub-apical dot; femora under side with broad white bands; legs with a cupreous tinge; femora whitish beneath. Wings grey; veins black, fringed. Length of the body $2\frac{3}{4}$ lines; of the wings $4\frac{1}{2}$ lines.

A very dark species, the type being almost black throughout, though it appears possible that the abdomen may have originally had some amount of adornment in addition to the very distinct apical spot on the dorsum. The two fork-cells are both short with long stems, which are, perhaps, longer than the cells, the bases of which are opposite. The anterior fork is longer and narrower, but not markedly so. The posterior transverse vein is placed almost even with the middle transverse.

Habitat.—Makessar in the Celebes (*loc. cit.*). Also at Waigiou, Mysol, and North Ceram. *Vide* "Proc. Linn. Soc.," VII., p. 202.

151. CULEX DOLESCHALLII, Mihi.

C. cingulatus, Doleschall, *l.c.*, *infra*.

Wings unspotted; tarsi unbanded (legs uniformly rufous); thorax unadorned, pale rufous; abdomen cinereous, with black bands, the position of which is not noted.

Description from Doleschall, "Natuurkundig Tijdschrift voor Nederlandsch Indië." X., p. 405, with plate.—Thorax pale rufous; abdomen cinereous, with its articulations annulated black; the legs hairy, and of a uniform rufous tint; the eyes green and gold; the wings spotless, and

ciliated on the margin and along the veins; the antennæ ciliate, with a nude apex. Length 8 mm.

Doleschall's specific designation for this species cannot stand, as the name had been already employed for another species of *Culex* by Fabricius ("Syst. Antl.," XXXVI., 11). Apart from the fact that the two descriptions indicate two widely different insects, the different geographical distribution, Fabricius' species being South American, while Doleschall's inhabits the Dutch Indies, would suffice to render specific identity very improbable. Besides this, Doleschall claims his as a new species, which he would not have done had he been aware that the name was preoccupied. Another name must therefore be found.

Habitat.—Java. Very common throughout the year in houses (Ambarawa).

152. **CULEX VENTRALIS,** Walker.

Wings unspotted; tarsi unbanded; thorax unadorned, brown (?); abdomen black, dorsally unbanded (?), but with six pure white bands on the venter.

There is so little left of the type that one can only make out that both fork-cells are long and narrow, with long stems, the transverse veins being placed far in.

Description from "Proc. Linn. Soc.," V., p. 144.—Female, brown; head marked with white above; proboscis straight, very little longer, than the thorax; abdomen with broad, pure white ventral bands; legs with cupreous and purplish tomentum. Wings greyish; veins black, fringed. Length of the body 3 lines; of the wings 5 lines.

Walker again describes this species, without any mention of his previous description, in "Proc. Linn. Soc.," VIII., p. 103, as below. ♀—Blackish; pectus silvery, abdomen with six silver-white bands on the ventral surface; femora silvery-whitish with the apices blackish; wings cinereous. ♂—Blackish; rostrum and palpi black, the former slightly bent downwards, a little longer than the thorax; pectus silvery cinereous; abdomen beneath with six silvery white

bands; legs long, slender; femora silvery-whitish, except towards the tips; tibiæ and tarsi setulose. Wings cinereous; veins blackish, fringed; fork of the sub-apical vein rather short. Length of body 4 lines; of the wings 6 lines.

Habitat.—Amboyna.

153. **CULEX SICULUS,** R. Desvoidy (1827).

Wings unspotted; tarsi without white rings, but banded brown; thorax pale testaceous, with greyer hairs, unadorned; abdomen banded, but position and colour of these not noted.

An ill-defined species.

Description from "F. R.," p. 298.—Proboscis pale yellow, with the apex brown in the ♀, but not in the ♂ (?); palpi and antennæ of the ♀ brownish; thorax pale brick-red, with greyer hairs; legs with the femora and tibiæ pale yellow, and the tarsi brown-ringed; knees with a distinct silvery spot in the ♂ (?); abdomen more or less brownish brick colour; pale yellowish in the ♂, with a brown band on each segment. Length of the ♂, 2½ lines; of the ♀ 3 lines.

Habitat.—Sicily.

154. **CULEX RUFINUS,** Bigot.

Wings unspotted; tarsi unbanded (?); thorax rufous, unadorned; abdominal segments pale fuscous with broad bands, the position and colour of which is not noted.

Description from "Expéd. Scientif. de la Tunisie. Diptera.," p. 7.—Pale fulvous; the antennæ rather brownish; the thorax rufous above; the scutellum paler; the abdominal segments pale fuscous, broadly banded; wings very pale yellow.

Described from a specimen preserved in alcohol.—Of a pale yellow colour throughout, principally on the legs, the antennæ excepted, a little brownish; the eyes black; tergum reddish, with a little browning laterally; scutellum of a clear drab; abdomen with a broad, transverse, pale brown band on each segment.

Habitat.—Banks of the Chott el Djèrid, Tunis; in May.

155. **CULEX LURIDUS,** Doleschall.

Wings unspotted; tarsi unbanded; thorax unadorned, greyish-brown (?); abdomen greenish-black with bands, the position of which is not noted.

Description from "Natuurkundig Tijdsch. voor Neder. Ind.," Deel XIV., p. 384.—Greyish-brown, the abdomen greenish, with black scales; legs fuscous, hoary; wings pellucid with black veins. Length, 2½ lines (Dutch).

Smaller than *C. setulosus*, for the rest, almost of the same colour and marking; the abdomen narrow, cylindrical, greenish, hairy on either side, black haired on the back with broad cross stripes; legs hairless, light brown; the wings colourless with darker hairless veins.

Habitat.—Middle Java (Gombong) during the dry season in dwelling houses.

156. **CULEX MOLESTUS,** Wied.

Wings unspotted; tarsi unbanded (?); thorax reddish-brown (?); abdomen black.

Wiedemann describes an evidently different *C. molestus* in his "D. E.," p. 7, which he makes elsewhere a synonym of *Povrophora ciliata* (Fabr.). The separateness of the present species is, however, recognised by Van der Wulp, who includes it in his list of Asiatic Diptera.

Description from Wied., "Zweiflüg. Insect.," p. 544.—Reddish-brown, with the abdomen black. Length, 1½ lines. (German).

The specimen is noted as too defective to admit of minute description, but Wiedemann was able to make out that the proboscis, palpi, antennæ and legs appeared brown; the thorax deep reddish-brown; the abdomen black; and that the wings had brown scales.

Habitat.—Sumatra.

157. **CULEX MELANORHINUS,** Mihi.

C. pallipes, Macquart.

Wings unspotted; tarsi unbanded, brown; thorax with rufous scales, pale laterally; abdomen unbanded, dorsally brown, pale yellow on the venter; proboscis black.

I have been obliged to rename the above because the name *pallipes* has been used for what may be a different species by Meigen, and as the two date from the same year it is unlikely that they refer to the same specimen. In Meigen's species the proboscis is yellow and the abdominal segments are basally banded. Still, the fact that both inhabit Egypt makes it very probable that the discrepancies are due to looseness of description on Macquart's part, for I have verified Meigen's description by comparison with his types in the Jardin des Plantes.

Description from Macquart, "D. E.," p. 33 (1838).—Fuscous; the thorax with rufous scales; the sides and pectus pale; wings with the first sub-marginal cell longer than the second posterior. Length, $1\frac{3}{4}$ lines; proboscis black; abdomen brown, pale yellow ventrally; fore coxæ and femora pale yellow; tibiæ and tarsi brown; wings rather yellowish.

"*Habitat.*—Egypt; brought by M. Bore.

158. **CULEX PINGUIS,** Walker.

Wings unspotted; tarsi unbanded; thorax unadorned, fawn colour (?); abdomen with golden pubescence, not banded: ill-defined.

Description, "Science Gossip," pp. 79-81 (1867).—Female.—Fawn-coloured, stoutly built; proboscis black towards the tip; with the abdomen clothed with almost gold-coloured pubescence; legs stout, paler; the wings ashen tinted, with fulvous, somewhat pilose veins. Sp. Ch.—Fawn-colour, stout; proboscis much longer than the head and the throat, black towards the tip; abdomen with slightly gilded down; legs stout, paler than the body,

tarsi darker; wings cinereous, veins tawny, slightly pilose, radial and sub-apical veins with long forks. Length of the body 3½ lines; of the wings 7 lines.

Habitat.—British Columbia.

159. CULEX FILIPES, Walker.

Wings unspotted; tarsi unbanded; thorax ferruginous; abdomen black, unbanded: ill-defined.

Description from "Proc. Linn. Soc.," V., p. 229.—Female; ferruginous; head and abdomen black; proboscis less than half the length of the body; legs blackish, very long; femora paler towards the base; wings cinereous; veins black, fringed. Length of the body 2½ lines; of the wings 4 lines.

The type is completely denuded, and from its appearance gummed to a card, it was in hardly better condition when it reached the describer.

Habitat.—Dorey, in New Guinea.

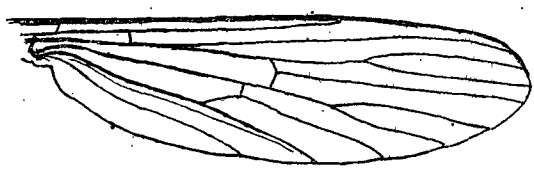
Genus VI. ÆDES, Meig.

This is a small genus, the number of known species being but small, and none of the species appear to be particularly common. Ficalbi only admits two European species, *Æ. cinereus* and *Æ. rufus*, but I found in the Jardin des Plantes one of Meigen's types labelled *Æ. obscurus*, which undoubtedly differs from these. I have been unable to find the description of this species, so can only give a few notes I took of its characters. Five species are recorded from North America, three from South America, three from the West Indies, one from Australia and none, up to the present, from Asia or Africa. In all twelve species, as some are distributed over more than one of the regions mentioned.

The essential character of the genus is that the palpi are very short in both sexes and the number of joints

appears to be small, though authorities differ a good deal in the number given; two, however, appears the most generally accepted number, and this will serve to distinguish the members of the genus from *Culex*, where only the female is obtainable. Where, however, but one specimen is available, the distinction is not easy, as it is practically impossible to make out the number without dissection, and hence it is quite possible that some species of *Culex* described from a single female specimen may really belong to this genus.

Of late there has been a tendency to restrict the genus by the addition of supplementary characters, Arribálzaga having instituted the new genus *Uranotænia* for two new species from Argentina, in which the first basal cell of the wing is distinctly shorter than in the normal *Ædes;* while Williston has added another, in which the palpi are five-jointed, which he has called *Hæmagogus;* but it appears better to retain the broad limits of Meigen's genus for the purposes of a compilation such as this.



The wing in *Ædes.*

The following description of the genus is taken from Ficalbi's "Revision of the European *Culicidæ*," and I have appended Skuse's note on the special characters of the wing in his Australian species.

Genus *Ædes*, Meigen, "Syst. Beschr.," Vol. I., 1818, p. 13; Macquart, "S. à B." Vol. I., 1834, p. 37; Zetterstedt, "D. Sc.," 1850; Walker, "I. B." III., 1856; Schiner, "F. A." II., 1864.

Antennæ porrect, filiform, fourteen-jointed, plumose in the ♂, pilose in the ♀. Proboscis porrect, the length of the thorax; palpi very short; wings scaly, incumbent.

Observation.—This is all the information given by Meigen, while Macquart simply says, "Palpi very short ♂ and ♀, pointed, thick at the base."

E. Ficalbi, "Bull. della Soc." Ent. Ital., 1896, p. 299, gives the following characters :—

"In addition to the characters of the family, the palpi, in both sexes, are much shorter than the proboscis. They are alike in male and female and consist of two stumpy organs, placed on either side of the base of the proboscis, resembling those of the female *Culex*, but are even shorter." Lynch Arribálzaga describes them as one-jointed, but Ficalbi finds them to be two-jointed, with a trace of a third articulation. They are rounded at the end, like those of the female *Culex;* and are hirsute, slender, setulose, scaly, but not tufted; nape villous; abdomen hairy, and clothed with scales. Legs long, ending in claws or processes, sometimes simple, sometimes toothed in the male, and simple in the female. The species are of small size which do not attack either man or mammals, an opinion confirmed by both Meigen and Arribálzaga.

Skuse, "Proc. Linn. Soc." N.S.W., 1889, p. 1760, gives the following characters for the wing, based on *Æ. venustipes,* which may be compared with his remarks on the other genera. Wings longer than the abdomen, narrow, elongate, densely ciliate, the veins densely clothed with eliptical scales which completely cover the wings; incumbent in repose. Humeral and subcostal cross-veins present, the latter placed much before the middle of the auxiliary; marginal transverse wanting. Second longitudinal, starting from the first, a little beyond the subcostal transverse, ending in a long narrow fork, with parallel branches. Third longitudinal bent sharply downwards at its base, and then running perfectly straight to the apex, starting a little nearer the fork of the second longitudinal than to its origin. Middle transverse placed close to the base of the third longitudinal. Fourth longitudinal ending in a fork like that of the second, its base lying before that of the latter. Posterior placed before the middle transverse and about opposite the tip of the sixth longitudinal.

Table of the Members of the Genus ÆDES.

A. Soberly tinted species, with the palpi with no more than two joints, and the first basal cell of the wing long. (Equivalent to the restricted genus.)

I. With the dorsum of the abdomen more or less distinctly banded or otherwise adorned with marks.

i. With the wing spotted and the tarsi banded.

1. *Æ. squamipennis*, Arribálzaga.

ii. With the wings unspotted, and the tarsi unbanded.

2. *Æ. fuscus*, Osten-Sacken. The abdominal segments with distinct yellowish basal bands.

3. *Æ. obscurus*, Meigen. The abdominal segments with indistinctly paler basal bands.

II. With the dorsum of the abdomen unadorned.

ii. With the wings unspotted.

a. With the tarsi thickly banded with minute white rings.

4. *Æ. venustipes*, Skuse. The last two hind tarsal joints are wholly white.

b. With the tarsi uniformly coloured.

5. *Æ. cinereus*, Meigen. Of a generally grey tint.

6. *Æ. rufus*, Gimmerthal. Of a generally reddish tint.

7. *Æ. purturbans*, Williston. Of a generally yellow tint.

8. *Æ. pertinans*, Williston. Of a generally brown tint.

B. Species brilliantly adorned with light blue; the palpi one-jointed and the first basal cell of the wing shorter than in Ædes normally. (Equivalent to *Uranotænia*, Arribálzaga).

I. With the dorsum of the abdomen adorned with marks.

ii. With the wing unspotted.

a. With the tarsal joints banded.

9. *Æ. pulcherrimus*, (Arribálzaga).

b. With the tarsal joints unbanded.

10. *Æ. Nataliæ*, (Arribálzaga). Abdomen with pearly bands.

11. *Æ. saphirinus*, Osten-Sacken. Abdomen unbanded. (?)

C. Brightly iridescent species in which the palpi are five-jointed. (Equivalent to *Hæmagogus*, Williston.)

II. The dorsum of the abdomen unadorned.

ii. With the wings unspotted.

b. With the tarsal joints unbanded.

12. *Æ. splendens* (Williston).

1. ÆDES SQUAMIPENNIS, Arribálzaga.

Abdomen black with the fore segments spotted and the hind ones distally banded grey; thorax unadorned, dusky grey or with reddish-grey scales; tarsi black with white rings, the last joint of the hind legs wholly white; wings with three ranks of white spots.

Description from "L. A.," p. 62. Dusky black; the thorax dusky grey, or with reddish-grey scales; the legs with white rings and spots; the wings with dense fuscous scales on the veins and three bands of white spots; head covered with dusky grey scales above and in front, behind silky grey with sparse black hairs; eyes with a very narrow silvery margin, green during life, dusky red after death. Antennæ blackish, with grey rings and black hairs (♀) or with less conspicuous grey rings but with dense fuscous verticils (♂); proboscis black, with white rings about the middle and near the apex, which is grey at the very point; scutellum fuscous; pleuræ more or less pitchy with frosty-grey scales; femora pale yellowish, but with dense black scales interrupted with silvery bars above, black at the apex and apparently thickened by dense tufts of scales; tibiæ pale yellow internally but barred, like the femora externally, with similar tufts of scales at the base and apex; tarsi black with white rings, the last joint wholly white. Wings with dense fuscous scales and marked with three transverse bands of spots, the outer two parallel, the inner row nearly at right angles with them; external marginal fringe variegated fuscous and white; abdomen dorsally black, opaque, its apex grey; the first four segments with dull grey spots on either side, the fifth and sixth with apical grey bands; beneath silky cinereous (♀) or dusky or black above with dusky fringes on either side, and blackish below with dusky grey villosity ♂. Length 4-5 mm.

Habitat.—Buenos Ayres. The specimens were caught on the window-panes of a house, in April. At first sight the species was taken for *C. mosquito*, which it much resembles in coloration.

2. ÆDES FUSCUS, Osten-Sacken.

Abdominal segments with whitish-yellow basal bands; thorax with golden tomentum, unadorned; tarsi unbanded (?); of a generally fuscous tint.

Description from "Bull. U. S. Geological Survey," III., p. 191. ♂ and ♀—Brown; thorax clothed with a short, appressed, golden tomentum; abdomen with whitish-yellow, narrow bands at the base of the segments; venter whitish yellow; antennæ black; proboscis and legs brownish, with a metallic reflection; femora paler on the under side; pleuræ, under the root of the wings, with a spot clothed with whitish scales. Length of the body 3-4 mm.

The author bred this species from larvæ, which he found in a pool, with those of several species of *Culex*. The larvæ and pupæ behaved exactly like those of *Culex*, and only attracted attention from their smaller size. This is the first record of an observation of the metamorphosis of *Ædes*.

Habitat.—Cambridge, Massachusetts, U.S.A.

3. ÆDES OBSCURUS, Meigen.

Abdominal segments brown with distinctly darker hinder borders; thorax dark brown, unadorned; tarsi unbanded; a distinctly darker species.

Description of the type in the Jardin des Plantes.—A very uniformly coloured and dusky species; the thorax and head dark brown, with the villosity of the same tint; the abdomen not very dark brown with darker hinder borders to the segments; tarsi brown, unbanded; the wings are hyaline; the first sub-marginal cell is narrower, but only a little longer than the second posterior, and the stems of both are very long, that of the first sub-marginal being a trifle the longer; the supernumerary and middle transverse veins meet each other in an open angle pointing outwards; of the two the middle being much the longer, while the posterior transverse is longer still and placed a little internal to it.

4. ÆDES VENUSTIPES, Skuse.

Abdomen unbanded, densely clothed with brown and white scales and fringed yellow; thorax brown, densely clothed with a mixture of brown and yellow scales, and adorned with an apical and two anterior lateral patches of yellow scales; tarsal joints thickly marked with minute rings, except the last two joints of the hind legs which are pure white.

Description from "S. A. C.," p. 1761. ♀.—Length of antennæ 1·13 mm.; expanse of wing 3·04 × 0·88 mm.; size of body 3·81 × 0·76 mm. Antennæ brown, about five-sevenths the length of the proboscis, with short, hoary pubescence; verticils brown, rather long; scapus with brown and white scales, the apical scales hiding the first flagellar; Head with a large patch of erect yellowish scales covering the front, with brown scales behind and laterally; some white scales on the hinder border of the eyes; proboscis deep brown, somewhat spotted with white scales, with a ring of white in the middle and a broader one immediately before the terminal lobes; palpi rather more than one-fifth the length of the proboscis, deep brown, the third joint dusted with white scales, and the last joint with a few white apical scales. Thorax deep brown, densely clothed with a mixture of brown and yellowish scales, interspersed with rather long brown hairs, with three oblong patches of yellowish scales, an apical and two lateral, on the anterior moiety of the thorax; pleuræ deep brown, with irregularly scattered white scales; scutellum testaceous, with yellowish and brown scales and brown hairs; metanotum deep brown; halteres deep brown, the stem testaceous. Abdomen about the width, and twice the length of the thorax, brown where denuded, densely clothed with brown and white scales, the latter predominating laterally and beneath; segments fringed with long yellowish hairs. Legs slender; coxæ deep brown with white scales; femora, tibiæ, and tarsi brown, thickly marked with very small rings and spots, saving the third and fourth hind tarsal joints, which are pure white, except the apex of the fourth; hind tibiæ three-fourths the length

of the metatarsi. Wings the length of the abdomen, hyaline, all the veins thickly beset with brown and yellowish scales, chiefly the former, which almost completely cover the wings, the veins being pale. These scales are broad and eliptical, differing greatly with those of any other species known to the describer, and he conjectures that this character may have a generic value; cilia brownish-grey; purple and blue wing reflections; auxiliary vein joining the costa a little before the base of the first sub-marginal cell; subcostal transverse placed a little before the origin of the second longitudinal; middle equal to the posterior transverse, placed considerably beyond the latter, and about opposite the middle of the hinder branch of the fifth longitudinal; anterior branch of the last issuing somewhat nearer opposite the origin of the second longitudinal than to the tip of the sixth longitudinal, the latter placed opposite the posterior transverse; first sub-marginal about the same length as, but scarcely longer than the second posterior cell, its base lying behind that of the latter.

Habitat.—Elizabeth Bay, near Sydney, Australia.

5. ÆDES CINEREUS, Meigen (1818).

Abdomen unbanded, chestnut colour; thorax unadorned, ferruginous; tarsi ferruginous, unbanded. Of a generally grey tint.

Description from "F. R.," p. 300.—Of a generally grey colour; proboscis and palpi blackish, as also the antennæ; nape slightly ferruginous brown; thorax with the dorsum having a brown ground tint, but generally of a reddish ferruginous; pleuræ blackish. Wings dark brownish-yellow, spotless; legs with the coxæ light yellow, and the tibiæ and tarsi ferruginous yellow, without any rings whatever; abdomen dorsally chestnut colour. Length about 6 mm.

Habitat.—Europe (Meig.); England (Walker); Scandinavia (Zetterstedt); Austria (Schiner); Italy (Rondani); but Ficalbi has not met with it, and in any case it is rare.

6. ÆDES RUFUS, Gimmerthal (1845).

Abdomen unbanded, brown; thorax dorsally reddish-brown, with indistinct median and a pair of lateral darker lines; tarsi unbanded, yellowish.

Description from "F. R.," p. 300.—Of a redder tint than the above; proboscis brownish-yellow, with the extremity brown; palpi and antennæ brown, the latter with the base yellow; thorax dorsally reddish-brown, with a darker median, and two lateral lines very indistinct; legs yellowish; abdomen dark brown. Length 5½-6 mm.

Further observations are required before this can be definitely accepted as distinct from *C. cinereus*.

Habitat.—Russia.

7. ÆDES PERTURBANS, Williston.

Abdomen varying from yellow to brown, unbanded; thorax generally yellow, unadorned; tarsi unbanded (?), brown; general coloration yellowish.

Description from Williston, "Trans. Ent. Soc. Lond.," 1896, p. 271. ♂ and ♀.—Head black; antennæ brown; plumosity of the ♂ long, abundant and black; terminal joint as long as the seven or eight preceding it together, and clothed with short hair; in the ♀ the joints are slenderer, and the end one is no longer than the two preceding ones combined; the verticils of moderate length; proboscis black, as long as the abdomen; palpi brown; thorax yellow; mesonotum a little darker, and clothed with brown scales; abdomen yellowish, yellowish-brown or brown, the terminal segment and the hypopygium brown or blackish, and clothed above with brown scales. Legs brown or blackish; the femora, for the most part yellow, with grey or purplish reflections in some lights; in some specimens the tibiæ largely yellowish beneath the tomentum. Veins of wings uniformly brown-scaled. Length 4-5 mm.

Habitat.—The Island of St. Vincent, West Indies.

8. ÆDES PERTINANS, Williston.

Abdomen unbanded, brown; thorax brown, unadorned tarsi unbanded (?), brown; of a generally brown tint.

Description from Williston, "Trans. Ent. Soc. Lond.," 1896, p. 271. ♂ and ♀—Face, basal joint of the antennæ and base of the proboscis yellowish; antennæ and the rest of the proboscis nearly black, the former only a little more hoary in the ♂ than in the ♀; the terminal joint of the ♂ only a little longer than the preceding ones; mesonotum brown, thickly clothed with dark brown scales; pleuræ yellow, with white tomentum. Abdomen deep brown with brown scales; venter yellow, with white scales; forceps of the ♂ small, yellow. Legs deep brown; the femora and in a less degree the tibiæ showing the yellow ground colour on the under side. Wings nearly hyaline; veins uniformly brown-scaled. Length 3 mm.

Habitat.—The coast of St. Vincent, West Indies; and on the hills at 1,000 ft.

9. ÆDES PULCHERRIMUS, (Arribálzaga).

Uranotænia pulcherrima, Arribálzaga.

Abdominal segments dusky with pearly apical cross bands; thorax testaceous, with a median longitudinal, a cross-band behind; spots in front of the wings and on the scutellum pale blue; tarsal joints dusky with apical white rings.

Description from "L. A.," p. 65.—Antennæ a little shorter than the proboscis, dark red-brown, basal joint large, testaceous; head testaceous below, metallic blue in front, covered behind with pearly scales; palpi minute, testaceous; proboscis a little longer than the head and thorax, the apical half with short hairs (♂), testaceous, with the apex fuscous. Thorax testaceous, the dorsum with a median longitudinal line of light silky blue, abbreviated behind so as not to reach a transverse band of the same colour on the suture in front of the scutellum; there is another blue spot on the middle of the scutellum, and lastly, a pair on the middle of the

sides of the thorax, in front of the insertion of the wings; *callus humeralis* metallic blue; pleura with pale blue spots. Wings hyaline with fuscous scales; halteres pale. Legs partly yellowish, the femora pale yellow at the apex and very base, with dense fuscous scales above; knees snowy; tibiæ fuscous, with the apex snowy; tarsi with the apices of all the joints snowy. Abdomen narrow, fuscous, moderately villous and hairy; with the segments apically pearly banded. Length, 2-2·75 mm.

This species is included by Arribálzaga, in his new genus *Uranotænia*, together with his *U. Nataliæ*, and *Ædes Saphirinus*, Osten-Sacken.

Habitat.—The province of Buenos Ayres.

10. ÆDES NATALIÆ (Arribálzaga).

Uranotænia Nataliæ, Arribálzaga.

Abdomen piceous, pearly banded, reddish in front; thorax dark fawn, darker in the middle, with a marginal, pale blue spot on either side in front; tarsi unbanded, piceous, their last joints pale reddish.

Description from "L. A.," p. 64. Antennæ deep pitch-brown; head testaceous in front and below, clothed behind with silky pale blue scales; eyes black, with narrow silvery margins; palpi extremely small, deep piceous; the proboscis of the same colour but slightly paler towards the base; with short fuscous pillosity in the ♀, or with the apical half with long fuscous hairs in the ♂; thorax dorsally dark fawn colour with a darker median line, and adorned laterally, in front of the wings, with a long pale blue, silky spot; and with a smaller one on each shoulder; pleuræ pearly; wings limpid, the veins moderately clothed with fuscous scales, which tend to pale blue in places; legs pale testaceous, with the apices of the femora, tibiæ, and tarsi dusky pitch-brown; halteres pale reddish with the knobs fuscous; abdomen piceous, almost bare, testaceous at the base, with pearly bands (transverse? or longitudinal?). Length, 2-2·50 mm.

Habitat.—The province of Buenos Ayres.

11. ÆDES SAPHIRINUS, Osten-Sacken (1868).

Wings unspotted; abdomen dorsally brownish; unbanded (?); thorax tawny brown with a median dorsal, and three lines on the pleuræ metallic blue; tarsi brownish, unbanded (?).

Description from "Trans. Amer. Entomol. Soc.," Vol. II., p. 47.—Fuscous; the frons, a median thoracic line and stripes on the pleuræ metallic blue; bases of the coxæ and femora pale; apices of the femora and tibiæ snowy. Front blackish, with a metallic-blue reflection along the eyes, especially in the middle; antennæ blackish, scapus tawny; those of the male apparently 15-jointed (13 + 2); flagellum with twelve beautifully bearded joints; a thirteenth, elongated, linear joint has some scattered hairs, but no beard like the preceding ones. Proboscis long, reaching in the male, if bent backwards, to about the middle of the abdomen; rather conspicuously incrassated at the tip; perhaps still longer in the female (the abdomen of my female specimen is somewhat injured); thorax brownish-tawny, darker above, paler on the pleuræ; a metallic blue longitudinal line along the middle of the thorax reaches the scutellum; three similar marks on the pleuræ, the upper of which is in the shape of a short line running from the base of the wing towards the head; abdomen brownish above, paler below; knob of the halteres brown, stem pale. Feet brownish, paler at the base; a snow-white dot on the upper side of the tip of the femora and of the tibiæ; when looked at very obliquely these white dots appear slightly pale bluish, and the tibiæ and tarsi likewise show a faint bluish reflection. Wings clothed with brown scales, but showing, in an oblique light, numerous blue reflections, especially a stripe near the basis between the third and fourth longitudinal veins.

Observation.—In my female specimen the scales are somewhat rubbed off on the feet, which for this reason appear pale tawny; still the white dots are distinctly visible. Length of the body, 0·13 in.; of the wings, 0·12 in.

Habitat.—The United States. (Washington, D. C.; Brooklyn, N.Y., by Mr. Brevoort).

12. **ÆDES SPLENDENS** (Williston)

Hæmagogus splendens, Williston.

Abdomen brilliant steel-blue, unbanded, but the segments adorned with lateral snowy spots; thorax unadorned, clothed with brilliant green and coppery scales; tarsi unbanded (?) blue.

Although not adopted for the purposes of the present work, the above brilliantly-coloured species is such a contrast to the usually sober facies of the genus, that I have little doubt that the genus will ultimately obtain recognition.

The characters of Williston's genus are as follows :—

Allied to *Ædes*. Palpi short in both sexes; five-jointed, the first and fifth small, the second nearly as long as the third and fourth together. Anterior claws of the ♂ unequally unipectinate, of the ♀ simple.

Description from Williston, "Trans. Ent. Soc. Lond.," 1896, p. 272. ♀.—In ground colour deep black, the base of the femora, and coxæ, in part, somewhat yellowish; occiput, mesonotum, and scutellum wholly covered with green and coppery scales; pleuræ densely snow-white scaled; abdomen brilliant steel-blue, black in some reflections; a spot on the sides of each segment snow-white. Legs blue, like the abdomen, shining black in some reflections; the under side of the femora with white scales towards the base. Wings hyaline, somewhat brownish in front; scales black, evenly distributed. Length 5 mm.

Habitat.—The Island of St. Vincent, West Indies, at an elevation of 1,000 ft.

Genus VII. **CORETHRA**, Ratke.

THIS Genus is sometimes coupled with *Mochlonyx* to form the sub-family of the *Corethrina*, which is distinguished from the rest of the family, or *Culicina*, by the comparative shortness of the proboscis.

The members of both genera are insects of the open

country, and do not appear to enter habitations, nor do I find any record of their attacking human beings. With the exception of *Cor. Manilensis*, Schiner, all are inhabitants of temperate climates, and none of them are as yet suspected of any complicity in the crime of transmitting malaria.

The following diagnosis of the genus is taken from the "rough notes" kindly lent me by Mr. F. V. Theobald:—

The bodies of these gnats are elongated and pubescent, the thorax oval, slightly elongated with a moderately-sized scutellum. The head is small, the eyes separate in both sexes; the proboscis much shorter than the antennæ, with two round hairy knobs in front. Antennæ fourteen-jointed, about as long as the thorax, very pilose in the ♂. Wings slightly shorter than in the abdomen, hairy, the veins fringed with scales; mediastinal vein ending at about half the length the wing, its two forks ending at the tip of the wing; cubital arising from the præ-brachial transverse; sub-apical forked towards its tip; posterior margin notched at the base. Abdomen hairy, long and slender; in the ♂ there are two curved, foliaceous, apical appendages, about the same length as the preceding segments; in the ♀ the abdomen ends in two small curved hooks, which are much shorter than the preceding segment. Legs long, slender, unarmed; coxæ of moderate size; ungues and onychia small.

Two of the three English species are sometimes very common, appearing in dense masses. They are found chiefly in damp, swampy places; the larvæ are aquatic, and are remarkable for their beautiful crystalline appearance.

Table of the Species of the Genus CORETHRA.

I. With the wings spotted.
  A. With the legs dotted or banded.
    a. With the antennæ banded.
      1. *Cor. pallida*, Fabr. Almost colourless but with a slightly reddish tint; abdominal segments with the distal border black; wings with one band

2. *Cor. Nyblæi* (Zett.). Dull white; the abdomen, lateral lines, and minute spots fuscous.
3. *Cor. punctipennis*, Say. Generally pale yellow with dusky hairs and down; wings with several clear brown spots.
4. *Cor. gibba*, Meigen. General coloration greenish, wings with a single band; characters of the legs and antennæ not noted.

II. With the wings unspotted.

A. With the legs darker at the apices of the tibiæ and tarsal joints.

a. With the antennæ unbanded. (?)

5. *Cor. pilipes*, Gim. Legs fringed with long hairs on the inner and outer sides.

B. With the legs uniformly coloured.

a. With the antennæ banded.

6. *Cor. plumicornis*, Fabr. Pectus and sides of the thorax whitish.
7. *Cor. Manilensis*, Schiner. Thorax pale orange, three longitudinal brown lines.

b. With the antennæ unbanded.

8. *Cor. culiciformis*, Deg. Much darker in coloration than any of the other species.
9. *Cor. flavicans*, Meigen. General coloration yellowish.
10. *Cor. rufa*, Zett. Generally rufous, with bright brown thoracic marks; legs more generally uniformly yellow.
11. *Cor. obscuripes*, Wulp. Generally darker than neighbouring species; abdomen dark brown with glossy greyish incisions.
12. *Cor. fusca*, Stæger. Almost black with the abdominal segments bordered whitish and the legs dirty yellow.

1. **CORETHRA PALLIDA**, Fabr.

Wings with an oblique brownish band in the middle; legs with numerous bands; antennæ black-ringed. Otherwise almost colourless.

Tipula pallida, Klass, "d Zoo," I., p. 34; and Fabr., "Ent. Syst." IV., p. 245; also Gmellin "Syst. Nat." V., p. 2026; *Cor. pallida*, Panzer, "Fauna Germanica," cix.

Meigen's specimen of this species in the Jardin des Plantes is in a very bad state, even the wings being too mildewed to make out the venation, but the first submarginal cell seems very narrow, especially at the base.

This species is very pale with a slight tint of reddish. The eyes are black; the antennæ whitish with a black band

on each joint; thorax with three clear brown stripes; abdomen nearly white, with a narrow black band on the hinder border of each segment; legs very pale and pubescent, with nine black bands on the femora and seven on the tibiæ. Wings with the veins very white and pubescent, except the transverse veins, which are brownish, so as to form an oblique spot on the middle of the wing. Length of the ♂, 2½ lines; of the ♀ 2 lines.

Habitat.—Europe, England, a comparatively rare species.

2. **CORETHRA NYBLÆI** (Zetterstedt).

Erioptera Nyblœi, Zet.

Wings with dusky spots and a band over the tranverse veins. Legs with apical dusky bands on the apices of the tibiæ and tarsal joints; antennæ banded.

Description from Zetterstedt, "Insec. Lapponica," Col. 830. ♂ and ♀—Dull, whitish, thorax with three brown lines, the middle one of which is double; meta-thorax with a double spot, with points on the wings, the knees and apices of the tibiæ and tarsal joints fuscous. Entirely dull whitish and markedly villous; antennæ pale with fuscous rings and long hairs; palpi rather fuscous. Thorax with obscurely bordered brown lines; the lateral ones short and placed behind, the middle one double at the base and produced beyond the middle of the dorsum of the thorax; meta-thorax with a double dusky brown spot; abdomen rather flattened in the dry specimen, with a sometimes interrupted fuscous lateral line and very minute puncta of the same tint. Wings hyaline grey, with markedly villous veins, the villosity forming the dusky spots mentioned above; the transverse veins drawn back into a semicircle beyond the middle of the wing, and obscurely villous so as to form a lunate band; halteres white. Length nearly 3 lines.

Habitat.—Norwegian Lapland.

3. **CORETHRA PUNCTIPENNIS,** Say.

Cor. trivittata, Loew.

Wings with several clear brown spots; legs with numerous brown dots; antennæ banded brown.

Although Loew's description is much the more complete, there can be little doubt that the above names are synonymous.

Description from Say, "Journ. Acad. Nat. Sci., Philadelphia," III., p. 16, and from Loew.

The shaft of the antennæ distinctly banded brown, with yellowish-white hairs; eyes black. Thorax with three yellowish-brown stripes; the middle one smaller behind and the others smaller in front. Wings with extremely clear brown spots; legs with numerous brown dots. ♂ very pale yellowish, clothed with long fuscous hairs and with down; antennæ banded black, with dense dusky verticils; dorsum of the thorax marked with three black lines, the median one of which is doubled behind, while the lateral ones do not quite reach the front. Scutellum laterally fuscous; metanotum nearly black; abdomen with black bands. Legs pale yellow, the first tarsal joint somewhat fuscous from the apex; the apices of the femora and the bases and apices of the tibiæ banded black. Wings ornamented with rather small greyish black spots. Length of the body $2\frac{1}{6}$ lines; of the wings, $2\frac{1}{2}$ lines.

Habitat—Maine, Osten-Sacken; Pennsylvania, Say.

Noted from the island of Porto Rico by V. von Röder, in "Entomolog. Zeitung.," Stetin, 1885, p. 338.

4. **CORETHRA GIBBA,** Meigen.

Wings with an obscure band. Characters of antennæ and legs not stated. Greenish.

Description from "Nouveau Dict. d'Hist. Nat.," article "*Corethra.*"—Green, with the corslet elevated and prolonged in front, and the wings white and marked with an obscure band.

5. **CORETHRA PILIPES,** Gimmerthal.

Wings unspotted (?). Legs with the apices of the tibiæ and tarsal joints darker; antennæ unbanded (?); legs beset with long hairs on the inner and outer sides.

Description from Gimmerthal, "Bull. Soc. Imp. Naturalistes de Moscou," XVIII., p. 279 (1845).—Head and thorax brown, the latter with some yellowish pubescence and scarcely visible darker stripes, the middle one of which is divided by a deeper longitudinal line; palpi and antennæ brown. Abdomen greyish brown, with pale yellow incisuræ and long hairs on either side. Legs pale yellow; the apices of the tibiæ and of the tarsal joints brownish; all the legs beset with long hairs on the inner and outer sides, which forms the distinguishing character of the species; halteres dirty yellow; wings yellowish on the costa. Length 3 lines (♂).

Habitat.—Riga.

6. **CORETHRA PLUMICORNIS,** Fabr.

Wings unspotted; legs uniformly coloured; antennæ reddish with brown bands; abdomen pale brown.

Description from Mr. Theobald's "rough notes."—*Cor. crystallina*, Deg., *Cor. lateralis*, Latr.; *Cor. Hafniensis*, Gmel.

This species can be at once distinguished from *Cor. culiciformis* by the brown-banded, testaceous antennæ, and by the pectus and sides of the thorax being whitish; the abdomen is pale brown and hairy. Legs pale testaceous and pubescent.

Habitat.—Europe, as far north as Denmark. England.

7. **CORETHRA MANILLENSIS,** Schiner.

Wings unspotted; legs uniformly pale yellow; antennæ yellow with black rings; abdomen without bands.

Description from "Reise der Novara," Diptera., p. 30.—Pale reddish-yellow, the thorax dull, with three more deeply coloured longitudinal stripes, the middle one of

which, clearly defined elsewhere, is diffuse in front; scutellum with a clearer median line. Abdomen somewhat glistening, with very delicate long hairs, the last two segments brownish. The claspers of the male genital apparatus extend to a length exactly that of the last abdominal segment; head clear yellow, the eyes black, the antennæ yellow with black rings, the tuft of plumes light brownish-yellow, the palpi clear yellow. Legs very pale yellow, almost whitish, the tibia fringed with long, but very fine, hairs. Wings yellowish with reddish-yellow veins, which are thickly fringed; the fork of the marginal veins somewhat longer than that of the discoidal veins. Length 2 lines (German).

The species corresponds in habit with *Cor. pallens*, Schiner, but can be distinguished at a glance by the uniform coloration of the legs.

Habitat.—Manilla.

8. **CORETHRA CULICIFORMIS** (Deg).

Wings unspotted; legs uniformly coloured; antennæ unbanded; darker in colouration than most of the other species.

Meinert.—"Overs. K. Dansk Vidensk. Selsk," 1883, p. 16. *Tipula culiciformis*, De Geer, "Mém. pour serv. à l'Hist. d'Ins.," VI., p. 372 (1776).

Description from De Geer, *l. c.* Dusky brown, with ferruginous hairs, the thorax marked by an obscure median double line, the metanotum blackish, the abdomen pale with the dorsal scutes densely armed for the most part with dusky black hairs; palpi and antennæ dusky black, the antennæ of the ♀, broadly, or in the ♂, narrowly, banded paler, with ashy bristles at the apex; halteres pale with brownish knobs; legs pale yellow, the knees and the apices of the first tarsal joints, and the hinder joints entirely fuscous; wings smoky in the ♂, yellowish in the ♀. Length, $2\frac{1}{2}$-3 lines.

Habitat.—Europe.

The following additional points are derived partly from notes on a specimen of Meigen's in the Jardin des Plantes, and partly from Mr. Theobald's "rough notes" :—Thorax glabrous, pale reddish brown, with a deeper coloured, V-shaped, dorsal mark, apex forward, which perhaps might be interpreted as a short anterior median, and two longer, oblique, lateral lines; the abdomen is ferruginous, each segment with a narrow dark anterior and a broad lighter posterior portion; legs pubescent, testaceous; wings slightly grey tinted, veins testaceous, covered, and the borders edged with scales and hairs. The supernumerary transverse vein is obsolete, the middle, rather long, and the posterior short. The first sub-marginal cell is shorter and broader than the second posterior, and the stems of both are longer than usual, the transverse veins being unusually near the root of the wing. Both the fork-cells are very narrow. Length 3 lines.

Habitat.—Europe and southern England, sometimes appearing in great numbers, but not generally abundant.

9. **CORETHRA FLAVICANS,** Meigen.

Wings unspotted; legs unbanded; antennæ black, unbanded; generally pale yellow.

There is a specimen labelled with this name by Meigen, in the Jardin des Plantes. Though not so colourless as *Cor. pallida*, it is of a very pale yellow tint throughout, except the eyes, antennæ, proboscis and palpi, which are all black. The thorax is glabrous, mainly chestnut brown, with a fine median white line and two large round, lateral snowy spots. The abdomen is of a pale ferruginous colour, the fore borders of the segments being rather darker; legs pale ferruginous without any markings; wings pale iridescent yellowish, the veins of the same colour; both the first submarginal and the second posterior cells are long and narrow, the former being a trifle the longer; the bases of the cells are nearly opposite, their stems short and of nearly equal length. About the same size as *C. pallida*.

Description from Meig., "S. B.," p. 243. Yellow with the sides of the thorax whitish; clear yellow, almost sulphur-yellow on the hairs of the antennæ and the legs; the thorax is whitish at the sides. Length, ♂, 2½ lines.

Habitat.—The specimen in question is from Germany.

10. **CORETHRA RUFA,** Zetterstedt.

Wings unspotted (?). Legs sometimes with the joints apically banded. Antennæ unbanded (?). Of a generally rufous colour with bright brown marks on the thorax.

Description from Zetterstedt, "Insec. Lapponica," 808.—Rufous with obscure brown marks on the thorax, dorsum of the abdomen fuscous, the legs yellow. ♀—Like *Cor. plumicornis*, F., but differently coloured, being entirely fuscous testaceous. Antennæ often pale; thorax with a double median stripe, and an ovate spot on either side, of bright brown; abdomen pubescent, fuscous above, with a median testaceous line at the base, sometimes extending beyond the middle; venter pale. Wings pale with markedly villous veins; halteres pale. Legs yellow, either spotless, or with the apices of the femora, tibiæ, and tarsal joints fuscous. Length 3 lines.

Habitat.—Lapland.

11. **CORETHRA OBSCURIPES,** Van der Wulp.

Wings unspotted (?). Leg uniformly (?) dusky. Antennæ unbanded (like *Cor. rufa*). Of a generally more dusky tint than the neighbouring species.

Description from Van der Wulp, "Dipt. Neerlandica," I., p. 333 (1877).—Like *Cor. rufa*, Zett., but of a darker colour. Thorax ash-grey with dark brown bands; the lateral band between the neck and the root of the wing narrow and light grey; scutellum brownish; abdomen dark brown, with glossy greyish incisions. Legs brownish-grey, the coxæ and bases of the femora yellowish; hairs on the ventral aspect brown; halteres yellow. Wings of a grey tint with light brown veins.

Cor. culiciformis differs from this species in having the hairs of the abdomen yellow, while *Cor. fusca* has the scutellum and legs alike yellowish.

Habitat.—Holland.

12. **CORETHRA FUSCA,** Stæger.

Wings unspotted (?). Legs without band or spots (?). Antennæ unbanded (?). (Said to resemble *Cor. culiciformis*). Generally dusky black.

Stæger's heading shows he is doubtful whether this be a new species or identical with *Cor. culiciformis.*

Description from Stæger, "Naturh. Tidsskr.," (Kröyer), Bd. II., p. 556 (1839).—Fuscous black; the thorax behind with a lateral line and the scutellum pale; antennæ with black hairs. Distinguished from *Cor. plumicornis* by its smaller size. Body dark brown with stiff hairs; borders of the abdominal segments whitish. Legs dirty yellow. Length $2\frac{1}{2}$ lines.

Habitat.—Denmark.

Genus VIII. **MOCHLONYX,** Loew.

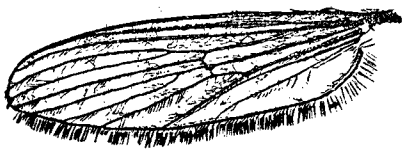
In this very peculiar genus the legs differ from those of all other members of the family in having the second tarsal joint longer than the first, instead of the latter being, as in the other genera, one of the longest in the entire appendage.

Another singular point is that, while the imagines much resemble those of *Corethra*, the larvæ are more like those of *Culex.*

Mr. Theobald, to whom I am indebted for the following diagnosis, is, I understand, of the opinion that in reality but one species, *Mochlonyx velutinus*, Ruthe, can be considered as established, and that the others are but synonyms.

In this genus the proboscis is much shorter than the head and thorax, but rather longer than the head. Palpi four-jointed and twice as long as the proboscis; antennæ

fifteen-jointed, the last two joints longest and vericillate; joints increasing in size from base to apex. Tranverse veins rather more distant from the margin than in *Corethra*, otherwise much the same, the veins being very delicate; the branches of the forked veins more than twice as long as their stems; ungues large, with a distinct accessory tooth.



Wing of *Mochlonyx velutinus*. From a photograph by Mr. G. C. Bignell, late R.M.L.I.

1. **MOCHLONYX VELUTINUS,** Ruthe.

Thorax brown with golden yellow hair and two closely approximated darker longitudinal stripes; scutellum and meta-thorax also brown; abdomen pale yellow with transverse brown stripes, which are clearer and broader on the hinder than on the fore segments, and on the last segment occupy the whole of the upper side. Head, antennæ and palpi brown, plume lighter, nearly rusty-yellow; legs yellow; tarsi brownish, ungues blackish-brown. Wings transparent with golden-yellow veins clothed with scales.

Habitat.—Europe, including England.

2. **MOCHLONYX EFFOETUS,** Halliday.

Brownish-red, with yellowish down, almost of a golden gloss; bands on abdomen longer; front thickly clothed with yellow hairs; palpi fuscous; antennæ fusco-ferruginous, paler at the base; sutures of the thorax delicately marked with fuscous; hinder edge of abdominal segments and lateral lines darker; pleuræ paler. Wings hyaline, a little yellowish towards the costa; veins pale, fusco-ferruginous; halteres pale with fuscous at the tip; legs pale ferruginous

with fuscous hairs; hind femora slightly embrowned before their tips. Four ♀ in Mr. Clifton's collection. Not now traceable.

Habitat.—England.

3. **MOCHLONYX CULICIFORMIS** (De Geer).

Meinert; "Overs. K. Dansk Vidensk. Selsk, p. 16 (1883).

Tipula culiciformis, De Geer, "Mém. pour servir à l'Hist. d' Ins." VI., p. 23 (1776).

Fuscous brown with ferruginous hairs, thorax with an indistinct double median line; metanotum blackish; abdomen pallid, the dorsal terga for the most part densely sprinkled with dusky black; palpi and antennæ dusky black, the antennæ of the ♀ broadly and of the ♂ narrowly banded with ashy hairs at the apex; halteres pallid with a brownish knob; legs pale yellow, with the knees and apices of the hind tarsal joints fuscous. Wings smoky in the ♂, yellowish in the ♀. Length, 2½-3 lines.

De Geer also gives a long account of the life history of this species, *l. c.*

Habitat.—Europe.

FINIS.

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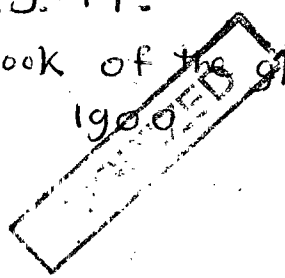

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